Electrical Review

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Electrical Review

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A POPULAR DELUSION.

Municipal ownership of electric light plants, etc., is well discussed in Professor G. D. Shepardson's paper, which ends in this number of the ELECTRICAL REVIEW. Municipal ownership is a species of contagious infection which breaks out sporadically, much as the mumps and measles do, in small towns and cities. The fever gets into the municipal blood and brain, and recovery is more or less rapid according to the violence of the attack. Those places that pass through the serious crisis of actually building a municipal plant recover slowly but very completely. Those that stop short of this acute phase are subject to recurring attacks. There is no cure for the trouble so efficacious as actual experience with a plant owned by the public and managed by the politicians. In the United States the history of municipal electrical undertakings has been one long chapter of failure, and the features of each case have been practically identical. The place is a town of, say, ten or twenty thousand inhabitants, hard-working people for the most part, who have to count their expenditures closely. The municipal government is almost always thoroughly honest but highly inefficient. The town has issued bonds for school houses, for paving, for a town hall and various other public improvements, but still has a margin before it reaches the limit of indebtedness set by its charter. There is an electric light company, too often there are two of them, and the streets are lighted by contract.

Some citizen suddenly discovers that the electric light company is making money out of "the people." He argues at once that if the company makes a profit from the sale of light, the municipality could also, or, what amounts to the same thing, could get the same amount of light for less money. He talks in the town council and at public meetings, the newspapers take the matter up, it becomes an issue in local politics. The electric light company is a corporation and therefore necessarily wicked; from the point of view of the agitator it has no rights. The question goes to a popular vote, and by an overwhelming majority it is determined to build a plant. All this time the agents of several contractors have been supplying data and figures to the committee or clique that is working for the municipal plant. This is natural, and not improper, because it is the nature of men with goods to sell to try to make a market for them. One of them secures the contract and the plant is built. Of course no engineer is employed, for by this time the committee in charge feels that it knows all about the lighting business and needs no advice. Generally the plant is well built, though frequently it is not.

At the end of its first year of operation a balance sheet is struck off, showing that street lighting is costing less than ever before. Everybody is delighted, the plant is working beautifully. It has cost only a nominal sum for repairs, being new. Nobody notices that such items as depreciation, remitted taxes, sinking fund for renewals, etc., are not charged on the balance sheet. Soon it becomes necessary to find a berth for one of "the boys"—for some broken-down politician out of a job. A soft "snap" is found for him at the electric light plant. Then the politician anxious for reelection discovers that the wages paid by the plant are too low. It is well known that if a man works for a municipal government he must receive more money for less work than he can get anywhere else, consequently wages are raised. And at the end of about five years the plant is for sale and the town council is advertising for bids for lighting and considering how large an increase of the tax rate the citizens will stand. This is the average history of a municipal plant in this country.

GOOD ROADS.

The subject of good roads has been vigorously agitated in the United States of late years, partly through the efforts of bicyclists and automobilists and partly on account of the general realization of the immense cost and burden of such roads as we have. In a recently published report of the geological survey of the state of Maryland, it was stated that during the ten years ending in 1899 the sum of six million dollars had been expended in that state in repairs to old roads and construction of new ones. Notwithstanding this fact, however, the estimated cost to the farmers of Maryland of the bad roads they have, was not less than three million dollars a year. In other words, improved roads would have lessened the cost in labor and money of the transportation of agricultural produce in Maryland by this enormous sum.

The United States Department of Agriculture, in a report embracing data from twelve hundred counties situated in a majority of the states of the Union, deduces that the average cost of hauling freight by horse traction on the average dirt road is twenty-five cents a ton-mile, as against eight and one-half cents per ton-mile in six European countries where good macadam roads are the rule.

These facts have an important bearing for the electrical engineer. The state of Maryland is not a large state, and is well supplied with railroads. It is probable that the average distance to which farm products have to be hauled in carts and wagons is less than in the majority of states, yet in this one state the annual saving that could be made, simply by having better roads, would pay five per cent interest on sixty million dollars. This saving would be greater if in place of road traction there could be constituted a haulage of these products on rails by electric motors.

When the island of Porto Rico was first brought under American control, it was found that methods of interior communication were practically confined to one military road crossing through the centre of the island. Engineers sent to report upon the situation with reference to the construction of roads were of the opinion that it was cheaper and better not to build any roads, but to cover the island with a system of narrow-gauge tramways that could be operated at considerably less expense for the haulage of freight.

Narrow-gauge lines, using light rails and careless of grades and curves, can be built for very little money in normal times. They will certainly be cheaper, even including their electrical equipment, than good roads. Is it not possible that in this direction will be found the solution of a difficulty which has so long depressed the agricultural classes in this country?

STORAGE BATTERY CARS ON NEW YORK STREETS.

For some reason New York city has been the last stronghold of the horse car in the United States. On its streets are some relics of the dim past that should end their existence in a museum. On Chambers street, on Forty-second street, on One Hundred and Tenth street are running to-day boxes on wheels that make our country cousins visiting the metropolis laugh long and loud. On Thirty-fourth street the horse cars are better, but it is on this street that the storage battery car is to replace the hippomobile and begin, it is firmly believed as well as earnestly hoped, a new era in traction in New York and in the United States.

It has been strange that the development and improvement of the storage battery due to the popularity of the electromobile has not sooner been made the occasion for an installation of accumulator ctreet cars. When an elaborate experiment with such cars was made in New York, twelve years ago, it failed, but the wonder of it was that at that time it came so near success. To-day the motors and controlling gear of electric street cars have been brought to a point of high perfection, and the accumulator has been greatly improved. On a reasonably level street the accumulator car now has every prospect of success; indeed, so good a prospect that it is a practical certainty. And there is a large and important field for the storage battery car. The fascination of its simplicity, its independence of conducting systems, its ability to go anywhere that a track was laid, that so caught the engineers and investors of 1888, still remains. It is an ideal system of traction for a large city, and the time has come for its development and exploitation as a serious addition to the transit facilities of the world.

AN OPPORTUNITY FOR WIRELESS TELEGRAPHY.

On June 24 the last authentic dispatch that has been received to date left the beleaguered city of Pekin. It is now over three weeks since any news has been received from the Europeans there, and this failure of the usual electrical means of communication has attracted the attention of the entire civilized world. It is not impossible that other places in China may soon be cut off from communication in the same way, and it is natural to speculate what difference would have been made had the besieged town been provided with wireless telegraph appliances.

There are certain places in the world, well known to students of strategy and to politicians, that are liable to be besieged. These include practically all capitals, numerous treaty ports and military stations. In view of what has happened in China, it seems as if the commonest precaution would dictate the establishment at all such points of means for signaling independent of lines of wire which may be destroyed with such great ease. Had the foreign settlement in Pekin been provided with signal masts and the simple apparatus necessary for wireless telegraphy, the world would not rest to-day in anxious suspense concerning a matter of most vital importance to its civilization.

In these torrid July days what would we do without the fan motor? How much do we owe the genius who first thought of raising the wind in this ingenious way, and how little do we honor the memory of his deed! Yet the amount of suffering and perspiration that has been saved, the thousands of collars that have been enabled to maintain their uprightness, the profanity that has kept unspoken on account of this satisfying little device, all join to swell its account of good deeds performed. And this is not all; it is a good, profitable, long-hour customer of the electric light station. A large load of fan motors (on metered circuits) is a good, steady source of income, especially in the season when the lighting load is small. Few small inventions have been of such general all-around value.

A Successful Submarine Boat.

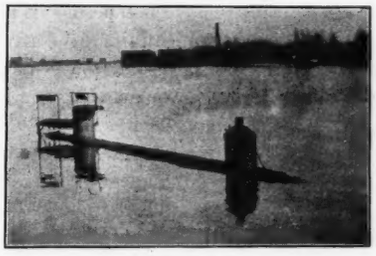
For some time past experimental work has been going on at Milwaukee, Wis., with the Raddatz submarine boat, which is shown in the accompanying illustrations. The results of the trials through which the new submarine craft has been put are such as greatly to please the inventor and those associated with him.

The boat is about 65 feet long and about four feet in diameter in the middle, tapering to a point at either end, and having somewhat the traditional cigar shape. At the top of the boat are two domes or conning towers, the entrance to the boat being through the forward dome. This is only 20 inches in diameter, and, necessarily, the boat, on account of its small dimensions, is not a very comfortable craft for cruising; it has been operated in order to test the principles of its design, and having served its purpose it is intended now to build a larger and improved vessel of the same type.

When cruising on the surface the boat is driven by an oil engine of about 10 horsepower. This is capable of giving the vessel a speed of from six to seven miles per hour. When submerged, the boat is driven by an electric motor, fed from 62 cells of storage battery and giving power enough to produce a speed of from four to four and one-half miles per hour. At this time it is not desired to make public the details of the controlling mechanism by which the boat is navigated under water, on account of the incomplete state of the experimental work and for reasons connected with the patent office. It is, however, of interest to describe some of the salient features of the working of the vessel, which is said to be entirely different from all other submarine boats that have been constructed.

When every thing is ready the boat can sink in from 30 to 40 seconds, disappearing entirely from view in a few seconds. It reaches a depth of 40 feet below the surface, which is as far as it has been tested. The ascent to the surface is made just as quickly and as conveniently. It is claimed by those interested in the vessel that it can be held at any given depth for a reasonable length of time without a variation of more than an inch or two. It does not have to dive or slant upwards when coming from the depths to the surface. No communication with the surface is maintained, the boat carrying its own supply of compressed air and also novel apparatus for purifying the air in its interior while it is down.

Mr. Benjamin T. Leuzarder, the president of the company which has been making the experiments, says that he has been down in about 40 feet of water for about two hours with two other persons in the boat. "In that time," says Mr. Leuzarder, " so far as I could determine, there was no difference in the air within the boat from that outside of it, except that it was cooler in the vessel because we were under water in a steel shell. At the expiration of two hours the air appeared to me just as sweet and pure as it was when I first entered the boat."



THE RADDATZ SUBMARINE BOAT FLOATING ON THE SURFACE.

Upon the same authority it is stated that three men could easily remain beneath the surface eight hours, and one or two men 12 hours and possibly 24 hours, without any ill-effects whatever. This, it must be remembered, is in the experimental boat and not in the larger sizes which it is proposed to construct in the future.

THE RADDATZ SUBMARINE BOAT IN DRY DOCK.

Those who have been experimenting with the boat have made no attempt as yet in the handling of explosives or with reference to the use of the boat as a torpedo boat. It is felt by the officers of the company that when the naval authorities are sufficiently interested to examine their vessel with a view to its use in warfare they will know better how to conduct such experiments as may be needful than can any private parties. It is believed that the vessel can be used to great advantage in many varieties of submarine work now performed by divers, and for wrecking. The depths at which it can be operated are limited only by the capacity of the vessel to withstand crushing under pressure of the water. The present vessel is constructed so that it can stand submergence to a depth of about 100 feet.

The two illustrations herewith show the boat moving along the surface with its domes above water and the vessel in dry dock.

Wall Street and the Electrical Stock Market.

The week has been featureless in most respects, the general interest in the political situation having decreased since the conventions of both great parties have been held, and in advance of the excitement of the actual presidential campaign. The growing belief that the worst has happened in Pekin tends rather to relieve the situation from a financial point of view, since it makes evident that desperate haste in the relief of foreigners in that city is no longer needed, gives time for the preparation of an adequate military exhibition, and makes absolutely necessary the concordant action of the great civilized powers of the world.

On the New York Stock Exchange, General Electric closed the week at 130 bid and 132 asked, a gain of 1 point for the week. Metropolitan Street Railway closed the week at 150¾ bid and 151 asked, a gain of 1¾ points for the week. Third Avenue Railroad closed the week at 110 bid and 11 asked, showing neither gain nor loss for the week. Brooklyn Rapid Transit closed at 53⅛ bid and 53⅜ asked, a loss of 1⅝ points for the week. Manhattan Railway, of New York, closed at 87⅝ bid and 88 asked, a gain of ⅛ point for the week.

On the Boston exchange, American Telephone closed at 144¾ bid and 145 asked, indicating a decline of ¼ point for the week. Erie Telephone closed at 96 bid and 100 asked, the only change in the situation being an increase of 1 point in the asked price.

On the Philadelphia exchange, Electric Storage Battery was not quoted. Union Traction closed at 37⅜ bid and 37½ asked, showing a loss of ½ point for the week. Electric Company of America closed at 9¾ bid and 9⅞ asked, indicating no change for the week.

On the curb, or outside market, in New York, Electric Vehicle Company closed at 19 bid and 23 asked, a gain of 2 points for the week. Electric Boat closed at 16 bid and 18 asked, a loss of 1 point for the week.

Wall street, July 14.

WHY SOME MUNICIPAL ELECTRIC PLANTS DO NOT PAY BETTER.

BY GEO. D. SHEPARDSON.

(Concluded from page 37)

Some of the reasons advanced by advocates of municipal ownership are:

The municipality should control the public utilities that affect the safety of the people. Therefore, it is warranted in supplying water for fire and sanitary purposes, constructing sewers, maintaining fire, police and health departments. The town should see that the streets are lighted for safety at night. How can it be done better than by the town itself, rather than by contract?

Some claim the town has no moral right to place the furnishing of necessities of life in the hands of "a legalized private monopoly with unrestricted powers," and leave the people helpless at the mercy of a corporation whose very existence was originally by the grace and favor of the people, a free gift at the hands of its later victims.

Since there is room for only one waterworks system, it being perhaps "a natural monopoly," the town is warranted in furnishing water for private use. In smaller towns there is not business enough to warrant starting a company lighting plant unless a favorable street lighting contract is secured. Hence if the town lights its own streets, it must also furnish electric lights for private use if the citizens are to enjoy these luxuries at all.

The town can furnish electric lights cheaper than a company, since it need not earn any dividends and pays no taxes. Some maintain the plant need not earn interest on the money invested, for the plant is bought with the proceeds of bonds, the interest on which can be charged up to general expenses of the town. Even if interest is charged against the plant, the municipality can hire money at a lower rate of interest than can a private corporation, since the whole property of the town is security and not simply that in the plant for which the bonds are issued, and the laws are such that the taxes can be collected without fail. On the other hand, the plant alone is security for bonds or other funds hired by a company.

Some also maintain that the plant need not earn anything for depreciation, surplus or sinking fund, for this can also be provided for by addition to the tax levy and the people would never know the difference.

It is claimed that the plant can be operated more cheaply by the town, for it need cost nothing to handle the business, since the town officials can keep the accounts and make collections as a part of their regular duties.

When the town already has a waterworks plant in operation or in prospect, it can supply electric light and power with little additional cost, since the building, boiler and men are there already, and it takes only a little more coal and wages to run the electric plant.

Perfect honesty may be expected in the administration of the affairs of electric light and water-works plants in all except perhaps the largest towns, for in smaller places everyone knows everyone else and all his affairs, the public affairs are known to all and there is no chance for stealing or other corruption. There may be aldermanic steals in large towns like New York and Chicago, but never in our town.

The large dividends on watered stock of gas and electric companies show that there is a large margin, which might be saved to the consumer in the case of municipal ownership.

By operating a municipal plant, prices will be so low that electric lights can be enjoyed by poor people and not by the rich only. As a matter of fact, the prevailing prices for street and commercial lights are considerably lower with municipal plants than in other towns with private plants.

The extent to which the arguments in favor of municipal ownership have been accepted by the people, is indicated by the notable increase in the number of plants recently installed—take the experience in Minnesota as an example. According to Powers' Central Station Directory, in October, 1894, there were 10 municipal and 38 privately-owned central stations in Minnesota. In this classification, the term municipal refers to public ownership, whether by a village or city, while a company plant refers to privately-owned plants which furnish light for public streets or for other than the owner's use, not including what are known as isolated plants for supplying a single concern. The list as published in 1894 was as follows:

MUNICIPAL PLANTS.

Alexandria,
Arlington,
Brainerd,
Fulda,
Granite Falls,
Litchfield,
Luverne,
Rochester,
Sleepy Eye,
St. Peter.

COMPANY PLANTS.

Albert Lea,
Anoka,
Austin,
Brainerd,
Crookston,
Detroit City,
Duluth (1),
Duluth (2),
Fairmont,
Faribault,
Fergus Falls,
Hastings,
Le Sueur,
Little Falls,
Mankato,
Marshall,
Minneapolis (1),
Minneapolis (2),
New Ulm,
Northfield,
Pipestone,
Owatonna,
Red Wing,
Sauk Center (1),
Sauk Center (2),
Spring Valley,
St. Cloud,
St. Paul (1),
St. Paul (2),
St. Paul (3),
St. Paul (4),
Stillwater,
Tower,
Wabasha,
Waseca
West Duluth,
White Bear,
Winona.

A similar directory recently issued, when supplemented with information from other sources shows the following list for the present time:

MUNICIPAL PLANTS, 1900.

Adrian,
Aitkin,
Alexandria,
Arlington,
Austin,
Barnesville,
Blue Earth City,
Brainerd,
Breckenridge,
Chaska,
Dolano,
Elbow Lake,
Ely,
Fergus Falls,
Fosston,
Fulda,
Gaylord,
Graceville,
Granite Falls,
Henderson,
Hibbing,
Howard Lake,
Jackson,
Lake City,
Le Sueur,
Litchfield,
Long Prairie,
Luverne,
Madison,
Marshall,
Moorhead,
New Prague,
New Paynesville,
Ortonville,
Perham,
Preston,
Princeton,
Rochester,
St. James,
St. Peter,
Sleepy Eye,
Springfield,
Tracy,
Two Harbors,
Unionville,
Wadena,
Walker,
Waseca,
Wells,
Willmar,
Windom,
Winthrop,
Worthington.

COMPANY PLANTS, 1900.

Albert Lea,
Anoka,
Argyle,
Bemidji,
Benson,
Cambridge,
Cannon Falls,
Chatfield,
Clarkfield,
Crookston,
Detroit City,
Devil's Lake,
Duluth,
Eagle Lake,
Eveleth,
Fairmont,
Faribault (1),
Faribault (2),
Frazee,
Glencoe,
Glenwood,
Grand Rapids,
Hastings,
Kasson,
Kenyon,
Lake Crystal,
Lanesboro,
Le Roy,
Little Falls,
Mankato,
Mapleton,
Melrose,
Minneapolis (1),
Minneapolis (2),
Montevideo,
Mora,
Morris,
New Richmond,
New Ulm,
Northfield,
Owatonna,
Park Rapids,
Pine City,
Pipestone,
Red Lake Falls,
Red Wing,
Redwood Falls,
Rush City,
St. Cloud,
St. Paul (1),
St. Paul (2),
Sauk Center,
Sherburne,
Spring Valley,
Staples,
Stillwater,
Tower,
Virginia,
Wabasha,
West Duluth,
White Bear,
Winona,
Zumbrota.

The writer does not know to what extent the earlier directory was complete, but it is fair to presume that the proportion of omissions were about equal, *i. e.*, for the two classes of stations. Comparing these statistics, we find the number of municipal plants has increased in less than six years from 10 to 53, a growth of 430 per cent. During the same time the privately-owned central stations have increased from 38 to 63, a growth of only 66 per cent. The latter figure might be raised to a small extent by counting substations of the larger companies as separate stations. On the face of it, there were six municipal plants installed in Minnesota for every one privately-owned central station during the past six years. These figures are not quite so significant as might at first be supposed, for many of the municipal plants are in towns so small as not to warrant putting in a private plant except in connection with some other line of business. Minnesota was pretty thoroughly exploited (some think over-exploited) in the booming days of early enthusiastic promoters, and all of the larger towns had electric plants prior to the date first mentioned above. On the other hand, during this period of six years, the existence of a number of companies has been threatened by the practical confiscation through agitation for municipal ownership, although they have safely ridden through the storm in most cases. At other towns franchises have been sought by prospective investors and have been refused in favor of municipal ownership.

Let us next look at the other side and note some of the reasons urged against municipal ownership, or to meet arguments in its favor.

Public affairs are not usually administered as economically as private affairs, hence public utilities should be in the hands of private parties for best economy. The administrators of a public institution, such as a water-works or electric light plant, do not have the self-interest of those operating a private plant, for they are not usually expected to earn dividends, nor are they so closely watched, as "everybody's business is nobody's business." "Private management, in comparison with public management, is at least 20 per cent more efficient, saving and economical in every way, as a direct result of the self-interest in a profit producing industry." All other things being equal, this 20 per cent more than offsets any advantage public ownership may have in reducing costs, and it enables the private plant to earn a reasonable dividend while not increasing the actual cost of service to consumers.

Even where the officials are perfectly honest, public affairs are always administered less economically than private, the hours being shorter, the pay being higher as a rule, while the supervision is less exact.

Political pull usually puts the best men out and puts political loafers in positions where their ignorance, laziness and general incompetence militate against efficient operation of the plant.

The feeling that politics counts for more than merit prevents the employees in a municipal plant from having the proper ambition to excel that would exist in a private plant or in a public plant where civil service principles prevailed.

Even in the rare case where merit tells more than "pull," the city council changes its makeup every one or two years and a new committee is appointed to have general oversight of the city water and lighting interests.

These green committeemen must show their ability by insisting upon the superintendent following their notions, even against his own convictions. They stand in the way of his getting supplies and apparatus that he really needs, while they are quite willing that he should lay in large supplies of such sort as appeal to them. The superintendent is therefore apt to be extravagant in some directions while he must be niggardly in others, both of which militate against the economical operation of the plant.

While the municipal plant has no taxes to pay, the town is not the gainer thereby, for its treasury loses practically the same amount which the company plant would have paid. There may be an immediate saving to the town, since the company's taxes would have been divided among the town, county and state, so that the county and state lose some revenue in favor of the town owning a municipal plant. The handling of municipal property is notoriously corrupt, even outside of the larger towns.

The periodical waves of "turning the rascals out" and reforming the public expenditures, generally mean that the salaries of the superintendent and engineer are cut to such a point that no competent man can afford to retain his position, and incompetent or dishonest men take their places. It is true that "the corporation that pays small salaries in order to pay larger dividends will have to pay larger salaries in order to maintain dividends." A similar statement is true regarding salaries in municipal plants.

As a result of the incompetence or lack of appreciation of the situation on the part of the superintendent or city recorder, the records of many municipal plants are in such shape as to give little information as to the exact condition of the plant. In some cases there is not a complete record of bills receivable. Many have no record of the output of station, coal or water per kilowatt-hour, or even number and location of services, meters and lamps. Such things as pressure wires are unknown in many plants, and the lamp voltage varies to such an extent as to render the use of economical incandescent lamps out of consideration.

The reports of the low rates with municipal plants are due to several causes, usually to ignorance of the real cost. Expenses that should be charged against the electric plant are often placed against the water-works or against the general fund, and are often ignored until it becomes necessary to pay some bonds. Depreciation is often not considered, and when something finally gives out, a special appropriation is made for renewals and is charged against something other than the operating expenses of the municipal lighting plant. The result is that the rates received for electric lights are often considerably below actual cost to the town, and the saving to the people who take electric lights is made up by increased taxation of the whole people. If the town sells electric light below cost, it should in all reason furnish kerosene and candles at proportionally low figures. And why not groceries and dry goods likewise?

The argument as to the danger of placing the supplying of necessities of life in the hands of a private monopoly does not apply to electric light plants. If the service and rates are not such as to seem fair and reasonable, customers will reject electric light and will fall back upon other illuminants. Self-interest, therefore, prompts public supply companies to offer the lowest rates consistent with reasonable profits. Witness the active efforts of gas and electric companies to increase their business by all sorts of advertising, and note the continual reduction in prices as the earning capacity of the plant grows. It should be recognized, however, that the excuse for municipal ownership where private plants already exist, is often charged to alleged unreasonable and monopolistic attitude of the local company.

Public sentiment is not always based upon ultimate truth, being moulded often by spacious arguments that later prove defective. In the end truth prevails. Much of the contention for municipal ownership of public utilities comes from the circulation of incorrect reports of relative cost. A number of municipalities have learned by experience that it is cheaper to obtain electric service by contract rather than by municipal operation. To this day there is open the standing challenge of a well-known advocate of private ownership, that "There is not a municipally-owned gas or electric light plant in the United States which private capital will not take over and operate under contract at the same price the service is now costing, all factors of loss being correctly and fully considered, and all franchise rights enjoyed by the municipality being assigned to the purchasing private corporation."

The talk about giving away franchises is largely based upon a lack of appreciation of the benefits that accrue to a town by the investment of private capital in public utilities, increasing the advantages and facilities of the place, making it more attractive to other capital, bringing in new industries, increasing the population and greatly improving the conditions of living in the municipality. Concessions, percentages of income and other burdens are increasingly laid upon seekers for franchises. But it is also true that the companies recognize more than formerly the fact that obligations between the company and town are mutual.

In spite of the talk about large dividends on watered stock, it is probably true that the majority of central station owners would willingly sell out to the municipality at a reasonable price established by unbiased and capable appraisers.

From personal knowledge and the contributions of friends whose testimony is believed reliable, the following incidents are culled to show how the efficiency of municipal plants is less than called for by the theories of some political economists (private plants are far from perfect in their operation, and equally bad examples could be drawn from knowledge of their interior workings, were that subject under consideration at present). The illustrations point out the incompetence of those in charge of plants, the poor systems of records, the too-cheap economy in design and operation of plants, the low rates, the dishonesty of aldermen and the baneful effects of politics.

The state of the records kept in some of the municipal plants in almost incredible. In several towns there is no complete record of the service connections to the water-works and electric plants. In one place a new superintendent found it necessary to shut off the water to enforce the payment of back water rents. There was no plot of the water mains or services. He therefore was compelled to open the streets and search for the cutoffs, for which purpose the services of a chain-gang from the county jail were secured. In another town, when the collector was getting a promise of payment from a merchant, he was requested to bring in the bill for the meter in the barn at the same time. The collector held his own council and discovered a meter with a number of lights for which no record could be found. In that town, the only account books found were an electric light book with monthly columns for accounts of customers and an in-

dividual account book for water consumers, there being no record of purchases, repairs or any other expenses. In another place, by a careful canvass of the town and examination of the lines, water and lights were added to the record of about $900 income per year, and no one knew how long they had been getting free service In another place, where the rates are low and the water-power leaks badly so that it is necessary to spend several thousand dollars at once, the superintendent is confident that the plant is clearing about $800 net profits per month. In another town "there are no records and no system of accounts."

Closely allied to poor systems of bookkeeping is the incompetence of the city clerk or collector who has charge of records and collections. They do not understand the business and naturally do not make it pay. "The collector knew practically nothing of the station working, was ignorant of the station output, amount of coal used for electric part of plant, etc." "Owing to inefficient and incompetent officers, all sorts of prices were charged for supplies and work furnished the city. For example, a plumber was paid $2.20 for a common valve costing 90 cents, and other items in proportion." In another place the innocent recorder was beguiled into paying a higher price for a new lot of incandescent lamps, "because they had more watts than the kind formerly used."

The committees of the town councils are often "green hands" and of little value in administering municipal plants. In one place a former collector had been found short in his accounts and a committee was appointed to check his work. After two days upon his books, they made a report upon the shortage, which was made good and the bondsmen were immediately discharged. Soon after, when the water rents came due, a number of people were found to have his receipts for dues which had not been credited on the books, but the man's bondsmen had been released, and the town had a considerable sum to charge to profit and loss. A committee went over a lot of old accounts and found that their predecessors had approved reports in which there were serious defects, but lest they should seem to reflect on the abilities of their friends, the superintendent was instructed to call it square and open a fresh account with each person whose accounts were found faulty in former reports. A case recently occurred in a neighboring state to show how short-sighted some councils are in regard to franchises. A company applied for a franchise to furnish light and power from a water-power not far away, intending to spend about $30,000 in the plant. After dallying along for some time the franchise was granted by the council, but vetoed by the Mayor, who wanted a municipal plant. Although the town was already within $8,000 of its bond limit, they voted bonds in that amount to build a plant, hoping in some providential way they could put in a plant. In one town where a committee of the council was supposed to keep track of matters, a superintendent managed to do away with over 1,000 lamp renewals in a single year of which there is no account. Over $300 worth of fixtures sold without record were traced.

The superintendents of municipal plants are often incompetent. The superintendent of one plant where they still use 50-volt transformers, heard of the saving in using large transformers. So he bought one and tried to supply 50 lamps one block distant by a No. 6 wire. (Assuming one ampere per lamp and 400 feet to the block, this would give a drop on the line of about 22 volts). The superintendent was sure that No. 6 was large enough, for the insurance rules said it would carry it all right. The trouble was therefore in the transformer, and he compelled the agent to trade it for three small ones. The large one "did not regulate" as well as the small ones and he is sure that the modern idea of large transformers with secondary networks is a mistake and a failure, for he tried it. In another town of about 4,000 inhabitants, a technically trained superintendent is saving about $5,000 annually above the records of his predecessors. In a smaller town a similar man is saving between two and three thousand dollars annually to the town on account of more skillful management. He increased the revenue by $100 in a single month by using better transformers and lamps, although the station output was 10 per cent less. The station output was materially lessened by inspection of the circuits, and tying up the lines where they had fallen upon the cross-arms. Incandescent lamps on flat rates taking 58 to 70 watts were replaced by 53-watt lamps with marked economy. In another station the superintendent confided to an agent that he was bothered about learning the frequency of his alternator. The agent said it was too complicated a matter for him to figure off-hand, but he would calculate it when he returned to his office. The agent found that the practice of his own company in similar case was to use 125 cycles, and he reported that the superintendent had such frequency. As a matter of fact it was 140, and the speed was marked on the machine. In one town the chief reason why one alderman voted in favor of one system against a lower bid was that his preference was the machine with "kilowatts," while the cheaper machine was a "multipolar" machine, and he preferred kilowatts to multipolars.

In the laudable endeavor to secure economy, the mayor and council frequently lose at the bung while saving at the spigot. This occurs both in the first purchase of the plant and in its later operation. After one town had voted to put in a lighting plant, the mayor took a trip to learn what he could. After consulting with several agents and getting propositions from them he called upon an engineer who was given to understand his services would be required. After spending some hours pumping him, the mayor left and went home, where he concluded he was enough of an engineer himself to lay out the plant. So he bought some machines, hired a wireman and the plant was put in. At another place a resident bought up some second-hand machinery, and after putting it into operation sold it to the town for what it would cost when new. In a few weeks they had to spend about a hundred dollars for repairing the armature, and then had to buy a new machine.

At another place they decided to secure a cheap engineer to design their plant. He specified a 20-horse-power gasolene engine to operate a 600-light dynamo, and, in addition, to drive the pumping machinery for the water-works. The council made a contract for the gasolene engine as specified, including a proviso that if a steam plant was substituted, the gas engine contractor was to receive a commission of 15 per cent of the cost of steam plant. It is reported that this was actually done and paid. Two of the larger towns of the state were contemplating municipal ownership, and each secured the services of an inexperienced young man to prepare plans and specifications for the plants, in one case because he was a friend or relative of one of the committee, in the other case probably because he was cheap. The country is full of half-baked electricians who pose as engineers and as advisers to investors.

There is frequently an attempt to reduce operating expenses too far. At one place the council discharged a good engineer and hired another because he was cheap. Within three days he got his cylinder full of water and broke the girder of the Corliss engine. It is common, even with privately-owned station to attempt economy by hiring cheap firemen, since anyone can shovel coal or throw wood. But owners fail to recognize that by paying ten to twenty dollars more for securing a capable fireman they are apt to save his extra wages several times over in reduced fuel bills.

In some cases there is great loss on account of downright dishonesty of the superintendent or the council committee. "A city employing an honest superintendent, with liberal pay and some backing in the council, will often prevent small and also large steals which are almost invariably found in municipal departments, such as lamp renewals (on which it is difficult to keep accurate account or check), "rake-offs" on purchases for the plant for which in the end the city pays. One supply company offered a new superintendent as high as 20 per cent on all purchases the year round, as they had always done so. This is substantiated by old bills. Lamps are checked up once a month while burning and one is often asked to go easy in counting, being offered all sorts of bribes from cigars or drinks to considerable sums in cash. I know of officials receiving special concessions in this way amounting to several hundred dollars per year. All this could have been prevented by a proper system of checking, but at best comes down to one man being honest. "Carloads of wood have been sold 'by the car' by former superintendents. An investigation by an alderman indicated that a loss of over $1,000 per year had been received from

that source alone." In another place the city recorder is said to collect the accounts and sometimes sublets the job to his friends who knock down about half and turn the balance over to the recorder, who in turn transmits to the treasurer so much of it as suits his convenience, there being no records and no other system.

The political conditions prevent best results in many plants. Where the employees are appointed by aldermanic influence it is not uncommon for an underling to retort to his superior officer when corrected for some shortcoming, "Oh, well, I have more pull than you have, and what are you going to do about it?" In one town until recently the plant was operated by two parties, an engineer, who took care of the station, and a lineman in charge of outside work. These parties were not on speaking terms, and, of course each attributed all troubles with the lights to the other man's part of the plant. This state of affairs continued for several years, during which time the arc system was in bad condition, the lineman attributing it to the dynamo and the engineer laying it to the lamps. When a change was made, there were two applicants for lineman, one a young man who would have attended to business, the other was a young son of one of the aldermen and with little experience or ability. There were also two applicants for fireman, one a good man and the other a lazy, good-for-nothing fellow who claimed to have considerable influence in the country so that he could turn considerable trade to some of the stores in which the aldermen were interested. By combining forces the poorer man was appointed in each case. There is a continual struggle between the temperance and the saloon element in most of the towns and when a new election puts the opposition into power, the superintendent is almost sure to lose his place in favor of some friend of the new management.

The incidents noted above show that the question of the desirability of municipal ownership is one complicated by many elements that are often lost sight of by the advocates of municipal ownership. After all is said, the arguments must be modified by the "personal equation." It is largely a question of circumstances. A community, whether a hamlet or a metropolis, is a cooperative institution and should be run on business principles. Some manufacturing concerns find the best economy and the most satisfactory results in making all their product from the raw material. Others, differently situated with respect to plant and market, or with respect to character and constitution of the officers, find it more satisfactory to sublet the contracts for the manufacture of parts, confining their attention principally to assembling and marketing. Each may be doing the best thing under the circumstances. In the same way, some communities may find municipal ownership to be more economical and satisfactory than private ownership. A much larger number than is generally supposed find it really better to purchase their lights from other parties.

NOTES ON LIGHT.

BY WILLIAM ROLLINS.

NOTE CIV—LIGHTNING AND THE ETHER.

In relation to what was said in former notes about the necessity of matter for producing the phenomenon we call conduction, I show a half-tone print of a flash of lightning taken from a negative made by Mr. E. W. Walker, of Calumet, Mich. An examination will reveal to the left of the bright band a dark one, which is a place in the ether swept so nearly clean of matter that it neither conducts nor shines well.

FIG. 79.—NOTES ON LIGHT.

The recent declaration of $2.25 on the capital stock of the American Telephone and Telegraph Company gives to former shareholders in the American Bell Telephone Company, on the basis of the exchange of two shares of new stock for one share of old, $4.50 for the quarter, or a return upon their holdings upon the same basis as they have heretofore received. In 1881 Bell Telephone shares sold, at the highest, on a basis of about three and one-eighth per cent. At the present time the stock is selling on a basis of about five per cent. Last year as the highest the stock sold on an income basis of about four and one-eighth per cent. At the present market price of Long-Distance stock, the former holders of Bell are receiving a return of a little better than five and one-eighth per cent on the market price.

The Nebraska Telephone Company has filed amended articles of incorporation in the county clerk's office increasing the capital stock from $1,000,000 to $2,000,000. An official of the company said that there was no significance to the increase except to provide for extensions which it may be deemed advisable to make.

THE TELEPHONE IN ELECTRIC LIGHT PLANTS.

BY I. WOODARD.

I give herewith a suggestion for "chasing trouble" on arc or incandescent lines when not in operation. In my station I have a telephone which is also used between my residence and the station, which, by means of flexible cords, I connect to one or all of the lines running out of the station.

When I go out on the line to do any work, whether "chasing trouble" or not, I take along a magneto and a strong receiver, with which I can ring up my assistant at any time and from any place, by merely connecting to one line and to the ground through the instruments. I may say here, in regard to the ground connection, that I have found that merely shoving a screwdriver into the ground 8 to 12 inches will generally suffice. This device saved me more than its cost in a few months in time and trouble.

The whole rig need not cost more than $9, which would include a complete instrument in the station, magneto, transmitter and receiver, and a strong receiver to use on the line, the usual station testing magneto being used on the line. Telephones are so cheap nowadays that with the experience I have had with my telephone, I would not want to run any country plant with lines of over a mile in length without this simple outfit.

Electricity in Egypt.

A telephone system is in operation in Egypt, with headquarters at Cairo, and branches at Alexandria, Port Said and other towns. The company has a trunk line running from Cairo to within a few miles of Alexandria, but has been unable to complete it on account of government opposition, which is based on the ground that the telephone line would diminish the state receipts from the telegraph system, says the London *Electrical Engineer*. The telephone company employs male operators only, and these are required to be expert linguists, having to speak English, French, Italian, modern Greek and Arabic. There is also in Cairo an electric lighting central station supplying the very respectable output of 35,000 10-candle-power lamps. Brown-Boveri alternators, giving 2,000 volts at 40 cycles, are direct driven by Sulzer engines, and the distribution is through concentric cables. There are 90 transformer sub-stations, at which the current is stepped down from 2,000 to 100 volts.

SCIENCE BREVITIES

High Thermo-Electric Forces—Ever since Seebeck's discovery of thermo-electricity, or, as he called it, the "magnetic polarization of metals and ores by difference of temperature," says an *Electrician* abstract, it has been known that many oxides and sulphides possess high thermo-electric powers, some of them far in excess of anything found among the metals. Dr. A. Abt has systematically examined a number of these ores, such as pyrites, pyrolusite, pyrrhotite and chalcopyrite, between the temperature of 0 degree and 100 degrees. Taking the electro-motive force developed by a bismuth-antimony couple between these temperatures as a unit, that of a pyrite chalcopyrite is 10.8, and that of a pyrite-galena couple as much as 13.4.

Production of Cathode Rays by Ultra-Violet Light—M. P. Lenard announces an important development of the connection between electricity and light in the discovery that the discharge of electrified bodies by ultra-violet light is due to the production of cathode rays by the impact of the light. The hitherto accepted theory that the discharge was due to the mechanical disintegration of the electrode is rendered invalid by the fact that this would require the transfer of an amount of material such as could not fail to be detected by the spectroscope, and the spectroscope makes no such indication. The constant increase of the discharge with the exhaustion, as well as the strictly one-sided character of the discharge, suggested the probability of cathode rays being concerned in it. This was as good as proved by the following experiment, says one of Mr. Fournier d'Albe's abstracts: A vacuum tube was furnished with two electrodes, and exhausted until it failed to allow any discharge to pass. One of the electrodes was exposed to the ultra-violet light furnished by a spark-gap with zinc terminals. When the electrode was charged negatively it was instantly discharged by the ultra-violet light. A positive charge, on the other hand, was retained indefinitely. The potential is of no account, except the discharge is not so complete at low potentials, probably on account of a lack of energy of the cathode rays. That the electric charge proceeds in the form of rays is shown by the fact that if it is made to traverse a perforated electrode, a charge is received on an electrode in a line with the hole, but not on a lateral one. The beam can, however, be brought to impinge upon the lateral electrode by magnetic deflection. The ratio e/m comes out as high as 11.5×10^6, and the velocity as low as one-thirtieth of the velocity of light. The rays are not sufficiently intense to produce phosphorence of the walls of the tube. But it is now possible to produce these rays in an "absolute" vacuum, and with any given difference of potential.

Duplex Wave Telegraphy—M A. Turpain has devised a system of superimposing a wave message upon an ordinary continuous-current telegram without interference, and so utilizing the same wire for two simultaneous messages without going to the trouble of constructing dummy circuits. The wave message is sent by ordinary wire waves, but in order to prevent it rushing into the Morse electromagnet and destroying its insulation, the Morse receiver is enclosed in a metallic screen in contact with the magnet winding, and an electrolytic cell or an iron coil is also added to the receiving apparatus in order to force the waves into the line wire. The system can be applied either duplex or diplex fashion. It has been tested over a line of 350 metres of ordinary telegraph wire, and appears to have answered well. It was also applied to signaling over a guard wire of the Bordeaux-les-Chartrons electric railway, and does not appear to have been affected by the proximity of strong currents of the latter. But, on the other hand, no guarantee is given that existing telephone circuits would not be influenced, as we know they are influenced by other ingenious French devices, says the *Electrician*.

Spark-Length of Electrical Machines—Mr. W. J. Humphreys contributes a note to the *Physical Review* on the spark-length of an electrical influence machine, as modified by a small spark from the negative side. The author states that about 10 years ago he noticed that the discharging distance between the pole of an ordinary Toepler machine could be greatly increased by the aid of small sparks taken by the hand or otherwise from the negative pole, and also that this property was peculiar to the negative side. He made some experiments on the matter, and gives the results obtained. The experiments were tried on several machines and under several conditions. Thus with a machine with a roughened negative pole no good results were obtained, the negative pole losing its discharge so rapidly in the form of a brush that no long sparks were obtained. With a machine with a polished negative pole, however, the results were usually very good. The use of condensers did not give much increase in the spark-gap, and the atmospheric conditions also affected the length of spark but little. When the poles were widely separated no discharge passed, but on a slight spark being taken from the negative side a discharge passed from the positive pole and lost itself in the air. Nothing of the kind happened at the negative pole when a spark was taken from the positive. The author thinks that in a very modified form the electrical oscillations and surges would be the cause of the above phenomena. There are also other indications of the superior sensitiveness of the positive over the negative pole, and this is supported by the experiments of Faraday, MacFarlane and others. Thus Professor J. J. Thomson says of this that "we may express this result by saying that when the electrical field is not uniform the gas does not break down so easily when the greatest electro-motive intensity is at the cathode as it does when it is at the anode."

Some Relics of the First Telegraph Line.

Glass insulators through which the wire was run carrying the first message over telegraph line from Baltimore to Washington, 56 years ago, were recently discovered in the document room of the Senate by workmen who were taking measurements of the walls for the purpose of putting in new file cases. This is especially interesting at this time, as the anniversary of the first message was recently celebrated. While it was known that the insulators had been placed in some part of the Senate side of the building by Professor Morse, their exact location was not known to any of the present employees of the Capitol until discovered as stated.

PERSONAL.

Mr. J. S. Speer, general manager of the Speer Carbon Company, St. Marys, Pa., was a visitor in New York last week.

Dr. Oliver Lodge, D. Sc., L. L. D., F. R. S., professor of experimental physics in the University College, Liverpool, has been appointed principal of the University of Birmingham.

Mr. James F. Cummings leaves on the Teutonic to-day for London. Mr. Cummings, who is very well known in the engineering world for his work in the development of conduit systems for electric wiring, is now actively identified with the American Vitrified Conduit Company, of New York city. The company is meeting with success in the introduction of its underground conduit system in England.

A Wireless Telegraph Tower.

On the shore of Lake Michigan, one mile east of the little town of Cudahay, is a tower erected for wireless telegraph purposes by the American Wireless Telegraph Company, of Milwaukee. This tower is built of structural steel and is 155 feet high. From it, on a clear day, may be seen Racine light, 12½ miles to the south; Port Washington light, 40 miles to the north, and the water tower of Milwaukee, nine miles northwest. The tower stands on a bluff about 100 feet above the lake. In the illustration the lake is not visible, being in the background but concealed by the rise of the bluff.

From this mast, communication may be had with ships passing north from Chicago and with vessels plying across the lake, which has a width of 90 miles at this point. It is believed that this mast is the only substantial and permanent structure of the kind ever erected for wireless telegraph purposes.

A Mediæval Survival.

An incident the other day revealed the fact that Mr. Charles J. Hoadley, the elderly state librarian of Connecticut and a widely known authority on legal literature, has never used a telephone and will under no circumstances be induced to do so, says a daily contemporary. A judge of the superior court desired to ask him a question which he alone could answer and which demanded an immediate reply. Upon calling up the library at the capitol, Assistant Librarian George S. Godard, who answered the call, told the judge that the librarian had a prejudice against talking through the telephone, and added that it was doubtful if he would respond.

"Oh, I guess he'll talk to me," replied the judge, "and tell him it's very important that he should," he added.

When Mr. Hoadley got the message he remarked:

"If anybody wants to talk to me he knows where I am." He relapsed into the deep abstraction from which he had been aroused. He refused to discuss the reasons for his prejudice against the telephone, but it is popularly supposed that he considers it a new-fangled device, unworthy of consideration by him.

The following are the incorporators of the International Light, Heat and Power Company, of Philadelphia, recently incorporated under Delaware laws; G. B. Thatcher, Palmyra, N. J.; G. Ford, William Patton, D. M. Rattay, W. M. Pyle, all of Philadelphia.

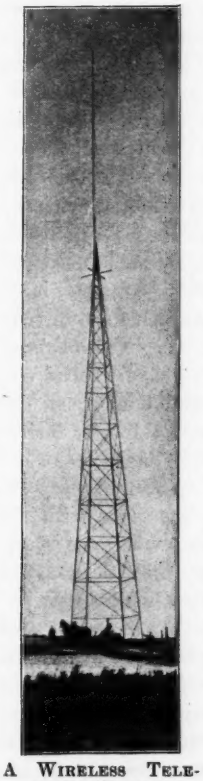
THE PROJECTED CABLE LINE TO THE PHILIPPINES.

BY CHANDLER HALE.

(Concluded from page 53)

The Anglo-American cable, laid in 1869, lived only 24 years. In that time there were 20 interruptions, of which the longest was of 10 months' duration, and, roughly speaking, the cable was interrupted five and one-half years out of the 24, the repairs costing over £300,000, or $1,500,000.

The three Atlantic cables of the Commercial Company's system, the first of which was laid in 1884, have been interrupted 78 times.



A WIRELESS TELEGRAPH TOWER.

If we now return to the so-called Arctic route, its most northern station on the direct line is Kadiak, in the latitude of Aberdeen, Scotland. The lowest temperature there recorded in 20 years' observation was five degrees above zero. Florida has had the mercury lower than that within the past five years. The average winter temperature of Kadiak is as high as that of the District of Columbia. The climate of the other stations is similar. Dutch Harbor lies in the latitude of Liverpool; Sitka in the latitude of Glasgow and between the same isothermals; Attu is as warm as the other stations. Dutch Harbor was once enclosed by ice for a few days in the Spring of 1864. The Asiatic coast is colder than Alaska, but at Petropavlovsk, which is 120 miles north of the first Asiatic station, the harbor is never blocked by ice. These few facts present a far milder picture than any that might be drawn of the Newfoundland Banks and the northern Atlantic, where 16 cables have been laid.

The northern cable would be laid along a gradually shelving coast. Any depth desired could be picked out, from 500 fathoms to 2,000. It is proposed to keep between 500 and 1,500, so that the average would not exceed 1,000.

On the southern route, no choice of depths is possible. There is no sloping shelf. Between San Francisco and Hawaii the mean depth is 2,500 fathoms, with a maximum of 3,073; between Hawaii and Midway Island the mean depth is 2,000, the maximum, 3,026; from Midway Island to Guam the mean depth is 2,600, with a maximum of 4,900, and with sudden and great fluctuations; from Guam to Luzon the average depth is 2,200, the maximum, 3,400.

The only objection that can be made to the northern route is that it does not include the island of Guam. However, if Guam is considered of sufficient importance to require a cable of its own, $1,000,000 will lay a slow cable from the Philippines to it.

In distance, the southern exceeds the northern route by 23 per cent. On the former line there are no natural stations, and it runs through the greatest uninhabited waste of water on the globe.

Our government as previously stated is now paying for cable communication with the Philippines about $400,000 annually, or, by the present roundabout way, $2.25 per word. More than three-fourths of this amount is expended by the War Department, and is directly due to the state of war now existing there. With the suppression of the rebellion such expense will be greatly reduced, probably more than 50 per cent; and yet a private company which should lay and own the southern route would insist upon a Government subsidy of $400,000 for 20 years, or rather upon a guarantee that it would receive that amount for transmitting all Government messages, even though the route would be much shorter than the one used at present, and would probably be operated in time of peace.

By the northern route, which would be 2,500 miles shorter from London to Yokohama than by the Indian cables, thus producing competition and lowering the rates, the Government could send its messages, not at so much per year, but at so much per word.

In the French army manœuvres, which will take place in the eastern part of that country this Summer, a number of different types of automobiles will be tried, such as petroleum and electric vehicles, motocycles, besides a number of heavy Scotte traction engines for the transportation of freight and baggage. The experiments are to be carried out on a large scale, and the organization has been intrusted to M. Journu, who has been for some time past engaged in the special study of applying the automobile to military purposes.

DIVERSE SERVICE FROM SMALL STATIONS

BY ALTON D. ADAMS.

Small electric stations usually distribute energy to three main classes of service —incandescent lamps, motors and arc lamps. All of these loads are commonly scattered over considerable area, a part of each being near to, and a part far from, the station. The load of incandescent lamps is often greater than that of arc lamps and motors combined, and is more apt to have its heaviest part located comparatively near the station. In order to serve this variety of consuming devices, over both small and great distances, a variety of generating equipment has often been installed.

It is not uncommon to find separate dynamos for direct current at 125 volts, direct current at 500 volts, alternating current at from 1,000 to 3,000 volts, and constant current, for series arc lamps, all operating side by side in stations of moderate capacity. While it is generally recognized that this diverse equipment is very unsatisfactory as to reliability, flexibility and in its effect on engine efficiency, a desirable substitute for it has in the past been lacking. The great simplification in electric generating equipment effected at some of the large plants by the substitution of high-pressure alternating dynamos for all other types at the main station, does not seem available for stations of moderate capacity. Large plants, with the high-pressure alternating-current equipment, complete their distribution systems through sub-stations, which transform the high-pressure energy to direct or alternating current of any desired voltage. Sub-stations being usually situated comparatively near to their several loads, are able to supply all consumers with one or two forms of electric energy and thus avoid the diversity of generating equipment found in main stations of moderate capacity. Loads of such stations are not sufficiently large to warrant their division among sub-stations, nor is the amount of service that can be rendered near a sub-station of low pressure enough to encourage its operation. It therefore seems that the greater number of small electric systems must continue to operate, at their generating plants, equipment that delivers the forms of electric energy required. It is quite possible, however, to materially reduce the diversity of generating equipment at small stations without neglecting any class of the service.

Three developments of the past two years are capable of advantageous application to electric service from small central stations. These are the incandescent lamp of high voltage, the induction motor and the double-current generator. Where the service area of a station is of such limited extent that its entire load can be economically reached by the 250-volt, three-wire system, very satisfactory results are attained by its use to supply incandescent and arc lamps and motors from the same generators. Equally good conditions exist inside and outside of the station for greater areas that can well be served from 450 to 500-volt, three-wire plants, except as to the incandescent lamps. The 220-volt lamps either show a higher per cent of breakage or must be operated at a lower efficiency than lamps of 110 volts, but this fault is not without its compensation, as incandescent lamps are often kept in use far past the period of economical life. Lamp manufacturers are quite sure to bring the life and efficiency of 220-volt lamps nearer to the 110-volt standard as time goes on, and the weight of advantage is decidedly with the higher voltage type for stations that must distribute directly to loads at moderate distances. The opportunity offered small central stations to extend their radius of operations to four times the present limits, for all kinds of service, from a single type of dynamo, so far as the cost of copper conductor is concerned, has come with the 220-volt lamp. Not a few electric plants that to-day supply arc and incandescent lamps and motors from independent dynamos could perform the same service, at a higher efficiency inside and out of the station, by a uniform 450-volt, three-wire equipment. The comparatively low first cost of the 450-volt equipment, as well as its greater reliability, are advantages additional to its superior efficiency of operation. Either the 250 or the 450 to 500-volt, three-wire system, with direct currents gives as satisfactory supply to arc and incandescent lamps and motors, within their respective radii of operation, as any method of distribution can give to either of these kinds of service. The apparent disadvantage of the arc lamps, because of the resistance necessarily included with them on constant-pressure circuits, is more than offset by the increased efficiency of station operation and the decrease of average line losses for the arc lamp load. In series arc service the line loss obviously remains constant, whatever the number of lamps that are operating at any time, while for constant-pressure supply to arc lamps, as to any other consuming devices, the watts lost on the line vary as the square of the load. Limited areas are by no means confined to the direct-current, three-wire system for an economical method of supply from central stations. Where alternating currents of the one, two or three-phase type are preferred, they can readily be distributed direct from the generating station to consumers' apparatus, over limited distances, without the intervention of transformers. For this work the alternating dynamos should be connected in simple parallel circuit, and their system voltage is therefore limited to that for single incandescent lamps, instead of being twice this amount, as in the three-wire system.

Unfortunately for the interest of moderate investments and efficient operation at small electric stations, the distances over which current may be economically distributed to arc and incandescent lamps and motors, on any constant-pressure systems, without the intervention of transformers, is decidedly less than those to be covered in many instances. To the ability of the small central station that operates a diverse load at moderate distances from a single type of generating equipment, must therefore be added power to render more distant economically and with the smallest necessary addition to station apparatus.

It may be accepted as settled that the elements of flexibility, reliability and economy, inherent in a single type of main generating equipment at central stations, are sufficient to warrant the addition of more or less auxiliary apparatus at the plant for purposes of distribution to the more distant loads. It is possible and practicable to install auxiliary equipment that will transform the output of low-pressure generators of any type, so that the energy may be readily transmitted to considerable distances. First cost and subsequent efficiency of operation, for the auxiliary apparatus, may vary much, according to the type selected, and the best combination for a particular case is, therefore, an important problem. It usually happens that all three of the common kinds of electric service; that is, arc and incandescent lamps and motors, must be provided for in the selection of auxiliary equipment, and it seems desirable that one type of auxiliary serve as much of this diverse load as is practicable.

The type of main generating equipment at the station should first be considered, as this will determine to a large extent the kinds of auxiliaries to be used. With low-pressure, direct, main generators, as for the three-wire system, high-pressure energy for distant loads may be

developed in any one of several ways. Rotary converters and static transformers may be employed to take the low-pressure energy from the main dynamos and deliver high-pressure alternating current for the distant distribution. If arc lamps are desired on the series system for street lighting, constant-current transformers may be supplied from the rotary converters for the arc circuits. The rotary converter may be designed to deliver three-phase currents, so that induction motors may be supplied from transformers at consumers' premises. In order to give satisfactory service at incandescent lamp the alternating current must have a frequency of at least 25 cycles per second, and to avoid any unpleasant effect on sensitive eyes the number of cycles had better be as high as 30 per second. On the basis of 25 cycles the direct-current dynamos must have 3,000 as the product of their revolutions per minute and the number of poles in each. Thus dynamos of four poles must have a speed of 750, and dynamos of 10 poles a speed of 300 revolutions per minute. The cost of transformers for this low frequency is somewhat more than that when the frequency is materially higher, as at 40 or 60 cycles per second, but this increase of transformer investment is not a very serious item. Should direct current be required for the series arc lamps, it can be had in one of two ways. Either motors, operated from the main dynamos, may drive series arc machines to supply the constant-current circuits, or the constant-current transformer, before mentioned, may have rectifiers placed in their circuits. The rotary converters, constant-current transformers and rectifiers will probably show a somewhat higher efficiency of operation than that of the combined motors and arc dynamos, but the first cost of the former equipment is the greater.

If low-pressure alternating dynamos are used at main generators at the central station, less auxiliary equipment is necessary, for most of the distant load, than is required with direct-current machines. Direct-current series arc circuits still require motors and constant-current dynamos, or they may be operated by constant-current transformers and rectifiers, thus avoiding the use of rotary converters, as is necessary where the energy is taken from direct-current dynamos. For incandescent lamps and motor loads at a distance, rotary transformers may be employed at the generating plant and they offer some advantages, especially where the main dynamos deliver direct current. As the rotary transformer is able to perform the work of both the static transformer and the rotary converter, it may be used at a plant with low-pressure, direct dynamos, to deliver high-pressure current, either direct or alternating of one or more phases. For the production of high and constant-pressure direct current from the low-pressure supply, the rotary transformer is, perhaps, the best equipment obtainable, but if high-pressure alternating current is wanted, the advantages of rotary converters and static transformers, compared with those of rotary transformers, as to first cost and efficiency, seem about equal. Where high-pressure alternating current is to be derived from the output of low-pressure alternating generators, the static transformer is obviously the best equipment for the purpose. If the main station dynamos are of the double-current type, the supply of alternating current to high-pressure lines requires only static transformers. When low-pressure direct current is generated at the main dynamos, their ability to also supply alternating current saves the cost and losses of rotary converters for the high-pressure service. Stations having only high-pressure alternating dynamos for main generators may still send out low-pressure current of either the direct or alternating type by the use of transformers and rotary converters for the former and of transformers for the latter current. If low-pressure alternating current is acceptable to nearby consumers, main generators may be alternating, of either high or low pressure, and this involves the least auxiliary equipment for mixed loads.

Consolidated Railway Electric Lighting Company.

At a meeting of the stockholders of the Consolidated Railway Electric Lighting Equipment Company, on July 6, the board of directors was completed by the election of these members: Walther Luttgen, of August Belmont & Company; Norma Henderson, of Henderson & Company; William Lanman Bull, of Edward Sweet & Company; Camillus G. Kidder, of Ivins, Kidder & Melcher; G. W. Knowlton, president of the First National Bank of Watertown, N. Y., and Thomas J. Ryan. The board includes Isaac L. Rice, John N. Abbott and August Treadwell, Jr.

Officers of the company are: President, Isaac L. Rice; vice-president and general manager, J. N. Abbott; second vice-president, August Treadwell, Jr., secretary and treasurer, J. L. Watson. Messrs. Luttgen, Kidder and Abbott comprise the executive committee.

AUTOMOBILES

Fire Chief Edward F. Croker, of New York city, goes to fires in a steam automobile, which he handles himself with the utmost disregard for danger. Recently, he has acquired a new vehicle, speeded for 35 miles an hour, and at this rapid speed the chief may be seen rushing through the streets whenever a big fire is on hand.

It is the intention of Collector Bidwell to institute an automobile service between the Appraisers' Stores and the Custom House, in New York city. This will give a much quicker service than the present cab service. At present two cabs are used to bring the invoices from the Custom House to the Public Stores. By the installation of one automobile, which will make regular trips to convey the official messenger with the invoices, it is expected a better service will be given. Collector Bidwell himself has for some time been using a private automobile to carry him to and from the Custom House.

The Automobile Club of America is collecting data for incorporation in the "Club Book," which it is soon to issue, relative to the location of shops and electrical establishments and warehouses where electromobiles and automobiles may be repaired, batteries charged and vehicles stored. This information is desired particularly for the vicinity of New York city and surrounding locality, as well as throughout the country. Information of this kind, which should be of benefit to the companies and establishments furnishing it, should be sent to Mr. S. M. Butler, assistant to the secretary, No. 95 Liberty street, New York city.

The Brooklyn Heights Railroad Company's car shops, at Thirty-seventh street and Church Lane, South Brooklyn, N. Y., have been rented by the De Dion-Bouton Motorette Company for an extended term of years, the intention of the company being, it is said, to establish a factory there for the purpose of building all kinds of horseless vehicles equipped with the motor which bears the name of the company. The company was organized under the laws of New Jersey, with a capital of $1,000,000, a few months ago, for the purpose of purchasing the patents and rights for this country of the De Dion-Bouton Company, which is the largest manufacturer of small motor vehicles in Europe. The gentlemen interested in the new company are: Fred C. Cocheu, president; James C. Church, counsel; P. H. Flynn, C. J. Field, vice-president and general manager, and A. A. Halsey, secretary and treasurer.

An Electromobile Run from Boston to Newport on One Charge.

Everyone acknowledges that the electromobile is the ideal self-propelled vehicle for city service, or for any service where the mileage does not exceed the capacity of one charge of its battery. People know that it is simple to run, makes no appreciable noise or odor, and is, generally speaking, offensive to none except an occasional very green horse. In view of its acknowledged advantages for the service to which it has been considered that it is limited, it is interesting to note that during the last year a good deal of progress has been made towards the development of a storage battery capable of furnishing mileages on single charges two or three times greater than obtained previously. It seems safe to say that the electromobile promises to become as reliable and convenient a conveyance for ordinary runs between cities and towns and throughout the country as it now is for service usually confined to the limits of cities.

Last week one of the Electric Vehicle Company's carriages was run on one charge of the battery from Boston to Newport over roads which made the distance 72½ miles. The total time consumed, including stops, was 5 hours and 18 minutes, and the average speed was over 14 miles per hour. The vehicle used was not designed for speed, and it was not attempted to make it. This run, however, with the other long runs recently made by electric vehicles, certainly indicates that the storage battery carriage is not only the ideal automobile from the point of view of simplicity and convenience, but that it is also being rapidly developed into a vehicle which can be used for any ordinary touring or for runs of under 100 miles, on a single charge of the batteries.

Opportunities for Electrical Work in Bombay.

In all India, Madras is the only city where electricity is used as a power for street railroads. Bombay's tramways are run by horse-power, and the city is lighted by gas. Electricity is used only in a limited way; in some of the better houses and bungalows and on an occasional fête or holiday, a public park may be lighted by a portable electric plant. The general merchant and dealer is not sufficiently acquainted with electric manufacturers to make a successful agent, and, besides, the demand for goods of this line is quite limited, says United States Consul William T. Fee.

Bombay is an immense city, with land and sea shipping equal to the best. It has large commerce and trade and manufacturing interests. Its buildings are said to be the finest in India, and much wealth is centered there. The appalling density of its population and the exhorbitant rates of rental must find relief in cheap and rapid electric transit. Electricity as motive power and light must come soon, and I hope our manufacturers and capital seeking new fields of profitable and safe investment will look well to this opportunity.

The Bombay Tramway, an American company, with head office in New York city, some time since applied to the municipality for the privilege of converting its power into electricity. This has not as yet been granted. The municipal commissioner, W. L. Harvey, has declared his intention of giving the city electric lighting, and the matter is now open for bids and offers. India possesses an inexhaustible supply of coal, and, while it is inferior to the Welsh coal, yet it is correspondingly cheaper and considered very good for steam purposes. It sells at this port for from 13 to 16 rupees ($4.25 to $5.25) per ton, according to the quality.

The capital stock of the Edison Illuminating Company, of Detroit, Mich., has been increased from $750,000 to $900,000.

Some New Types of Electromobiles.

There is no more difficult feature presented by the problem of automobile construction than that of maintaining perfect alignment between the forward and rear axles, and at the same time constructing the running gear of the vehicle so that it will readily adapt itself to the inequalities of the surfaces over which the wheels run. As everyone knows, in ordinary carriage construction this end is attained by making the running gear or frame connecting the axles of flexible materials and permitting it to bend and spring in passing over obstructions. In automobile construction, however, where much larger weights are carried and where the shocks are proportionately greater when the vehicle encounters a rut in the road or an obstacle to surmount, this solution of the difficulty is not feasible. In the new vehicles of the Hewitt-Lindstrom Motor Company, of Chicago, this peculiar difficulty has been obviated in a simple but entirely satisfactory way by connecting the front and rear axles to two bars or reaches, each of which is so connected with the rear axle as to swing vertically about a rocking joint, while its connection with the forward wheel is practically a universal joint. This simple and strong construction permits the wheels to move over very large

HEWITT-LINDSTROM STANHOPE.

obstacles without serious shock to the frame, and at all times preserves the alignment of the axles with reference to one another.

Perhaps next after the difficulty alluded to above is the rather serious question of suspending the motor in the running gear of such a vehicle so as to reduce the shocks and jars incident to the motion of the wheels over the surface, and at the same time preserve the proper relation of the motor pinion and the counter-gear so that the gearing may properly remain in mesh. It is, in fact, nearly the same problem that was presented to the manufacturers of electric street cars in the early years, except that the automobile has a rougher track to run upon and its frame has necessarily to be more flexible than that of the trolley car.

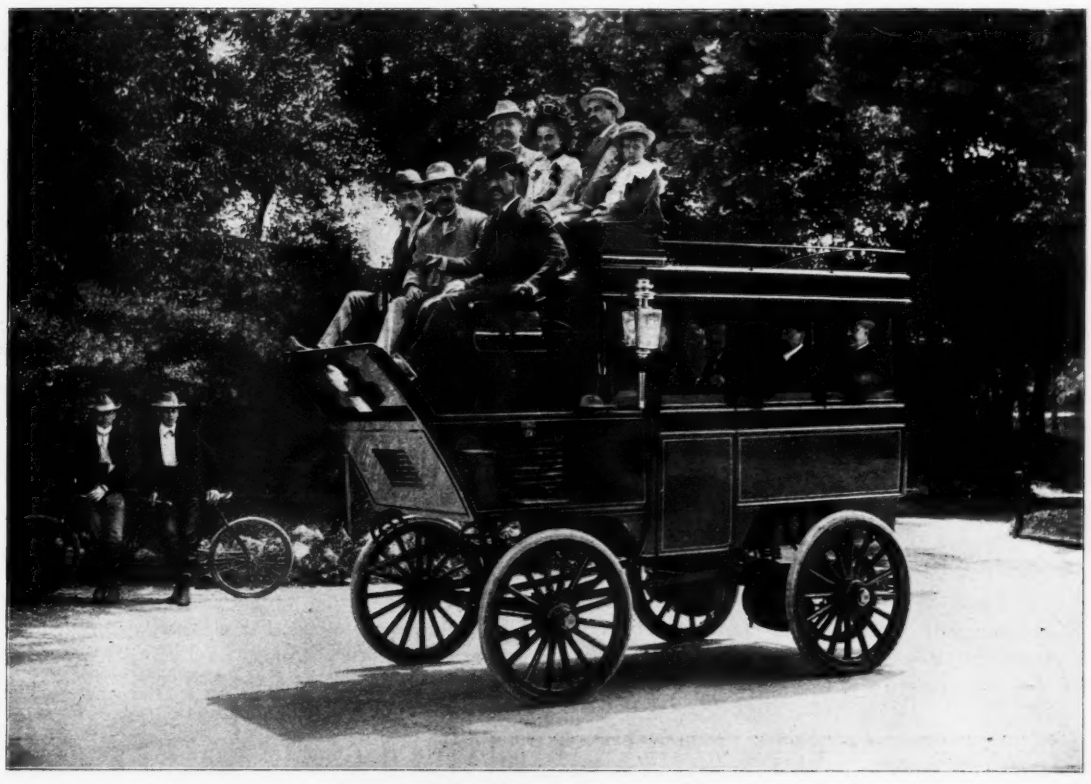
The suspension adopted by the Hewitt-Lindstrom Company is such that the motor hangs from brackets suspended from the rear axle and from a point forward on the reaches already referred to. The forward suspension points are also connected by means of cross-bars having proper hinge joints to take up the play of the running parts of the vehicle. Where the motor is suspended a rubber cushion spring is inserted so as to take up any jarring or shocks incident to the working of the vehicle.

A third peculiar feature of these vehicles is a spring strap break inside the motor-case so that dust and dirt are effectively excluded from the casing.

All of the many vehicles which the company has already produced have been designed by Mr. Charles A. Lindstrom. It is not only in the mechanical features described above that these vehicles differ from usual types, but in the electrical features as well. The controller has been greatly elaborated so as to produce a type free from heating at contacts and arcing. The motors are all of the multi-polar pattern, having four poles for small sizes and six for large sizes. It is claimed that these have shown admirable results on test, and that they will stand 50 per cent overload without undue heating. A circuit breaker is also provided on each vehicle, which is considered greatly to increase the safety of the vehicle in case of sudden emergencies.

On these vehicles the battery used is of higher voltage than that ordinarily employed, sometimes ranging as high as 120 volts, and on small types of carriages going as low as 104 volts. In an omnibus, recently made by the company, the weight of the vehicle was 5,400 pounds, the seating capacity 18 to 20 persons, and the radius of operation 56 miles on one charge. This vehicle carries two four and one-half horse-power motors, and, at a speed of nine miles per hour, consumes 25 amperes at 120 volts with 18 persons aboard.

The standard type of break built by the company seats four persons, weighs 2,540 pounds, has a radius of 40 miles on one charge and has a maximum speed of 12 miles an hour. Such a vehicle was built for a gentleman in Chicago, in December, 1898, has been since then in daily use without repairs either on motors or any other part of its mechanical construction. The stanhope shown in the illustration is a comparatively light vehicle, weighing only 1,600 pounds, its maximum speed is 16 miles an hour and it will cover over 40 miles on a single charge of its batteries. Mr. Lindstrom is to be congratulated upon the successful results that have attended the operation of his vehicles and the great ingenuity of their design. A very careful effort has been made to reduce the number of parts in the frame of the machine to the lowest possible and to dispense with all unnecessary screws, bolts, etc., thus making the vehicle simple and strong and not liable to get out of order, especially when in the hands of an unskilled driver.



HEWITT-LINDSTROM ELECTRCMOBILE OMNIBUS.

The LaPorte, Ind., Electric Company has filed articles of incorporation with the Secretary of State whereby its capital stock is increased from $75,000 to $150,000.

Miniature Incandescent Lamps.

The art of making incandescent lamps of very small size has greatly improved within the last few years and now these little lamps are made with great uniformity and the product can be guaranteed practically as well as that of large lamps.

The illustrations herewith represent a number of interesting types of battery and series incandescent lamps made by the American Miniature and Decorative Lamp Company, of New York. Fig. 1 represents a lamp made for two and one-half volts and 0.25 ampere and giving about one-half candle-power. It is used for certain surgical purposes and is claimed by the makers to be the smallest incandescent lamp ever manufactured as a regular product. The illustration, as is the case with the other lamps illustrated, is of the actual size of the lamp itself. Fig. 2 shows a socket lamp arranged for burning in series or from a battery. This is made in voltages of from 8 to 14 volts and gives six candle-power. Fig. 3 is a type of lamp designed for automobiles and for electric signs. It is made for 22 and 27 volts and in various small candle-powers. Fig 4 is a lamp made for use as an indicator on telephone switchboards. Figs. 5 and 6 show special lamps in which the filament is straight, as the illustration clearly shows. These are made for introduction into a reflector and are extensively used for bicycle lamps, small hand flash lamps, for theatrical effects, etc. They are made to burn on two, three, four or five cells of ordinary dry battery giving one and one-quarter volts per cell and range in candle-power from one-half to two. Fig. 7 is a surgical and dental lamp which has many advantages, principal among them being the ease with which it may be cleaned and the fact that no electrical contacts are brought into the mouth of the patient. All of these lamps contain a special filament known as the "Jaeger" metallic filament, for which extraordinary properties are claimed by the manufacturers.

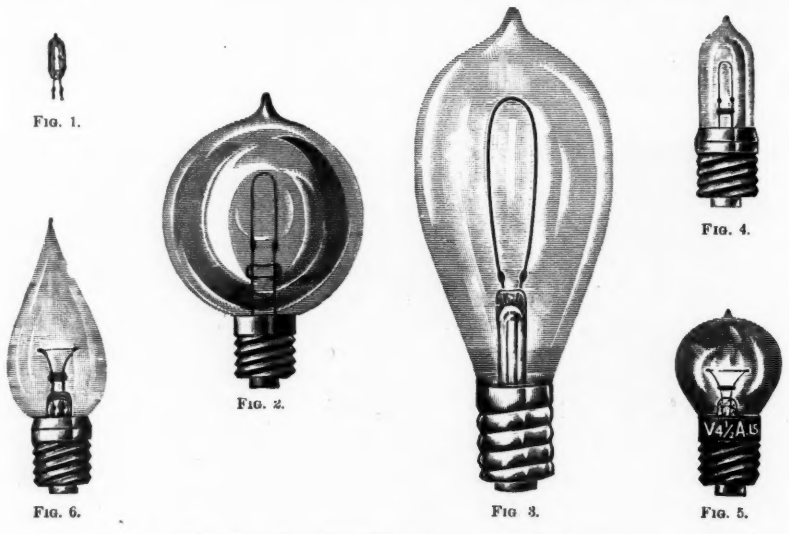


FIG. 1. FIG. 2. FIG. 3. FIG. 4. FIG. 5. FIG. 6.

FIGS. 1 TO 6.—MINIATURE INCANDESCENT LAMPS.

FIG. 7.—SURGICAL AND DENTAL INCANDESCENT LAMP.

A large electric light plant will be put in at the Cornucopia mines, in Union County, Ore. The waters of Pine Creek will be utilized to operate the machinery. Work on the plant will begin immediately.

The International Catalogue of Scientific Literature.*

In view of the proceedings at the third international conference, there can be little doubt that the ultimate execution of this important enterprise is now assured. Prior to the meeting some of us, perhaps, vaguely feared that the foreign delegates would come prepared to suggest all sorts of difficulties, if not to announce the unwillingness of the countries they represented to take any part in the work; but nothing of the kind occurred. All came bent on securing success; not a word was uttered in depreciation of any of the proposals brought under consideration, and all present may be said to have taken an enthusiastic interest in carrying the proceedings to a satisfactory issue. Every one was of the opinion that if a fair beginning can once be made—the importance of the work is so great, it will be of such use to scientific workers at large—it will rapidly grow in favor, and soon secure that wide support which is not yet given to it, simply because its character and value are but imperfectly understood. Therefore, all were anxious that a beginning should be made.

It has been estimated that if 300 sets or the equivalent are sold the expenses of publication will be fully met. As the purchase of more than half this number was guaranteed by France, Germany, Italy, Norway, Switzerland and the United Kingdom, the conference came to the conclusion that the number likely to be taken by other countries would be such that the subscriptions necessary to cover the cost of the catalogue would be obtained. The resolution arrived at after this opinion had been formed, "That the catalogue include both an author's and a subject index, according to the schemes of the Provisional International Committee;" must, in fact, be read as a resolution to establish the catalogue.

Of the countries represented at the various conferences, excepting Belgium, not one has expressed any unwillingness eventually to cooperate in the work. Unfortunately, neither the United States nor Russia was officially represented on the present occasion. The attempts that have been made to induce the government in the United States to directly subsidize the catalogue have not been successful; but that the United States will contribute its fair share, both of material and of pecuniary support, can not be doubted. There, as here, private or corporate enterprise must undertake much that is done under government auspices in Europe. As to Russia, the organization of scientific workers there has been so little developed that it is very difficult to secure their attention, and probably our Russian colleagues are as yet but very imperfectly aware of what is proposed. The importance of Russian scientific work is so great, however, that it stands to reason that it must be fully considered; and it may be supposed that Russia will join when she becomes acquainted with what is proposed and what is required of her.

A provisional international committee has been appointed, which will take the steps now necessary to secure the adhe-

* From *Nature*.

sion and cooperation of countries not yet pledged to support the scheme. Originally it was proposed to issue a card as well as a book catalogue, but on account of the great additional expense this would involve, and as the Americans in particular had not expressed themselves in favor of a card issue, it is resolved to publish the catalogue, for the present, only in the form of annual volumes.

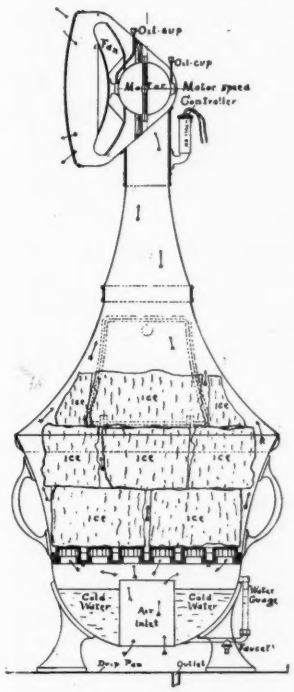


FIG. 1. — VERTICAL SECTION OF ELECTRIC COOLING MACHINE.

From the outset great stress has been laid on the preparation of subject indexes, which go behind the titles of papers, and give fairly full information as to the nature of their contents. Both at the first and the second international conference this view met with the fullest approval. Meanwhile, the action of the German Government has made it necessary to somewhat modify the original plan. In Germany a regional bureau will be established, supported by a government subvention, and it is intended that the whole of the German scientific literature shall be catalogued in this office; no assistance will be asked from authors or editors or corporate bodies. In such an office it will for the present be impossible to go behind titles; consequently, only the titles of German papers will be quoted in the catalogue. In the first instance, some other countries may prefer to adopt this course on the ground of economy. But in this country, at least, the attempt will be made to deal fully with the literature, and the cooperation of authors and editors will be specially invited. An author may not always be best able to judge which are the most important points in his paper to be noted in an index, but the experience gained in the Royal Society during several years past has shown that authors furnish most valuable information, and that their suggestions are easily reduced into shape. A full code of instructions for the use of the regional bureaus is now being prepared under the auspices of the provisional international committee.

The catalogue is to be published annually in 17 distinct volumes. The collection of material is to commence from January 1, 1901. As it will be impossible to print and issue so many volumes at once, it is proposed to publish them in sets of four or five at quarterly intervals. During the first year, parts covering shorter periods will be prepared, so as to make the subsequent regular issue possible of volumes in which the literature published during a previous period of 12 months is catalogued. Valuable opportunity will thus be given from the outset of gaining experience both in the preparation and use of the catalogue. That many difficulties will be encountered in carrying the work out can not be doubted; but if scientific workers generally will reflect on the inestimable value of accurate classified subject indexes, they can not but see that it will be to their great advantage to do all in their power to further the enterprise. If the attempt fail, it will only be because those on whose behalf it was undertaken are blind to their own interests.

Electric Cooling Machines.

Everybody is familiar with the whizzing fan motor, and on these torrid days is glad of its intimate acquaintance. However much the fan motor has done for the preservation of collars and the amelioration of Summer discomforts, it is perfectly well recognized that it does not cool the air. All it does or can do is to stir up the atmosphere.

The cooling machine illustrated herewith is an entirely novel departure, inasmuch as it actually cools the air as well as keeps it in circulation. Its construction is easily understood from the engravings, one of which shows the external appearance of the machine, while the other is a section exhibiting its working parts. In the top of the machine is a fan motor having blades of peculiar shape, which, it is claimed, reduces the noise of the fan to the absolute minimum. This fan surmounts a hopper or ice chamber into which a charge of ice is put through a door in the side. The larger sizes of machines hold 75 pounds of ice and the smaller 30 pounds. The air is taken in through an inlet at the bottom of the apparatus and first strikes the inlet pipe, which is surrounded by the ice-cold water which has dripped from the ice above. Thence the air passes through a grate upon which rests blocks of ice and which diffuses the current of air, so that it must come in contact with the ice at all parts of its journey through the apparatus. It is then blown out into the room by the fan, a screen being placed before the blade so as to diffuse the current of air and prevent its issuing like an Arctic gale.

The machine is made of hand-polished copper and brass, and is finely finished so as to be ornamental and adapted to any surroundings. It is especially useful in hotels, restaurants, theatres, hospitals, offices, etc. Naturally, its consumption of ice and the power required to drive it will depend upon the weather. The fan can be driven at various speeds dependent upon the amount of cold air required. Of course, more ice is needed on a hot day than on a cool one.

FIG. 2.—EXTERIOR VIEW OF ELECTRIC COOLING MACHINE.

The instrument is made by the Boston Electric Heating and Power Company, Boston, Mass.

Lightning Arresters for Direct-Current Circuits.

The success of the non-arcing, metal lightning arrester for alternating-current circuits led to further experiments by Mr. A. J. Wurts with the view of constructing an equally simple and efficient device for use on direct-current circuits. Experiments made with numerous combinations of the ordinary metals demonstrated the impossibility of constructing a non-arcing lightning arrester for direct-current circuits which could depend for its non-arcing property upon the material of the electrodes as was done with the alternating-current arresters, and therefore attention was turned to the possible suppression of the dynamo arc by virtue of the construction or relation of the parts.

Observation had been made of the remarkable ease with which destructive discharges strike over insulating surfaces, as compared with the difficulty they find in piercing the air. For example, disruptive discharges will strike over a glass surface, between two electrodes placed eight inches apart, rather than pierce the air between electrodes placed one inch apart and shunting the electrodes in contact with the glass. It was further observed that the discharge takes place still more readily if a pencil or carbon mark be drawn over the non-conducting surface; and that, in order to maintain a dynamo arc, fumes or vapors of the electrodes must be present. Placing these two ideas together; namely, "surface discharge" and "suppression of the vapors," the fundamental principles were obtained necessary for the construction of a simple and efficient non-arcing lightning arrester for direct-current circuits.

After many experiments the type "K" arrester was produced, as illustrated in Fig. 1. The arrester is mounted upon a marble base, and is intended for station use on direct-current circuits up to 700 volts. The instrument is single-pole, consisting of two metal electrodes mounted upon a lignumvitæ block, flush with its surface. Charred or carbonized grooves provide a ready path for the discharge. A second lignumvitæ block fits closely upon the first block, completely covering the grooves and electrodes. It has been found that disruptive discharges pass readily between the electrodes over the charred grooves, which act as electrical tracks through the air, providing easy paths. The resistance between the electrodes is more than 50,000 ohms, so that there is no current leakage; but the lightning discharge does not pass through this high resistance, as it leaps over the surface of the charred grooves from one electrode to the other, as would be the case were there but a single air gap, as the charred grooves serve only to make the path easier. As there is no space for vapor between the two tightly fitting blocks, no arc can be formed, and the arrester is non-arcing.

The Wurts alternating-current lightning arresters are non-arcing by virtue of

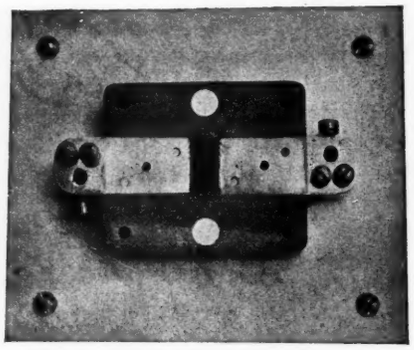


Fig. 1.—Non-Arcing Station Arrester.

non-conducting vapors which form between the electrodes during the first rush of current, but the direct-current lightning arresters are non-arcing by virtue of their construction, and, besides, they might be termed discriminating lightning arresters in that they allow disruptive discharges to pass freely, without allowing any dynamo current to follow. Among the machines first manufactured, it was found that there was a gradual wearing away of the wood fibre of the lignumvitæ blocks, and cavities were formed which filled with vapors in sufficient quantity to establish a dynamo short-circuit. This evil was cured by slotting the upper block at right angles to the charred grooves, so as to open up the grooves or discharged planes to the air, without, however, uncovering the electrodes.

Fig. 2.—Non-Arcing Line Arrester.

The type "L" arrester shown in Fig. 2 is constructed upon the same principle as the type "K," but being intended for car or line use, instead of being mounted upon marble, it is enclosed in an inverted cast-iron box with a lid on the bottom, the latter preventing any possibility of moisture reaching the arrester. The case is carefully insulated from the arrester and from the ground and trolley connections.

In direct-current railway systems, a proper distribution of spark-gap arresters will usually prove effective in protecting both motors and generators. In districts where natural conditions are not favorable to good earth connections, the possibility of damage from lightning in the power house is often a serious consideration. Damage to the generators means not only costly repairs, but loss of revenue while the station is shut down. For the better protection of generators, particularly for those exposed to frequent and violent thunderstorms, the type "T" tank arrester has been designed, and has proved to be a more effective protector than spark gap arresters in the station, and is a valuable addition to the protection afforded by line arresters.

The principle of the tank arrester is embodied in several direct connections to earth with intermediate kicking coils connected in the main circuit. The combination of these two features especially recommends it as a protection against lightning. Fig. 3 shows the general construction and method of installation; the kicking coils, mounted on a polished cherry board, are supported directly above the tank. The coils are 12 in number, connected three in series and four in parallel; each coil contains 11 turns of No. 0000 bare copper wire, making a total carrying capacity of 1,200 amperes for the four parallel rows. The tank is of polished cherry, lined with galvanized sheet-iron; its interior is divided into three compartments, so that water entering at the bottom of one compartment will overflow into the second, underflow into the third, and from the latter pass out as an overflow. This arrangement secures a very necessary circulation of the water, and prevents the accumulation of scum at the surface. Flat carbons, extending downwards, are adjustably supported over the centre of each compartment and are respectively connected by means of plugs and flexible cables to three points on the coil board.

The coil board has four sockets or plug connections as shown in the illustration, as it is desirable that a set of coils should always intervene between the generator and the plug connection nearest to it in the tank arrester. If the line connection be on the right of the coil board, the socket to the extreme left should be vacant.

If the line connection be to the left, the socket to the extreme right should be vacant. The inlet for water to the tank should be metallically connected to the water main, and should be provided with a faucet for regulation. With ordinarily pure water and a natural overflow from the tank, the dynamo current leakage is about three amperes per carbon; but with muddy water, or if it contains salts or acids, the leakage is liable to be excessive and to cause ebullition. This difficulty may usually be obviated, either by raising the carbons or by connecting a suction pipe to the overflow and causing thereby a more rapid change of water. For small plants the total output up to 1,000 amperes may be passed through a single set of coils.

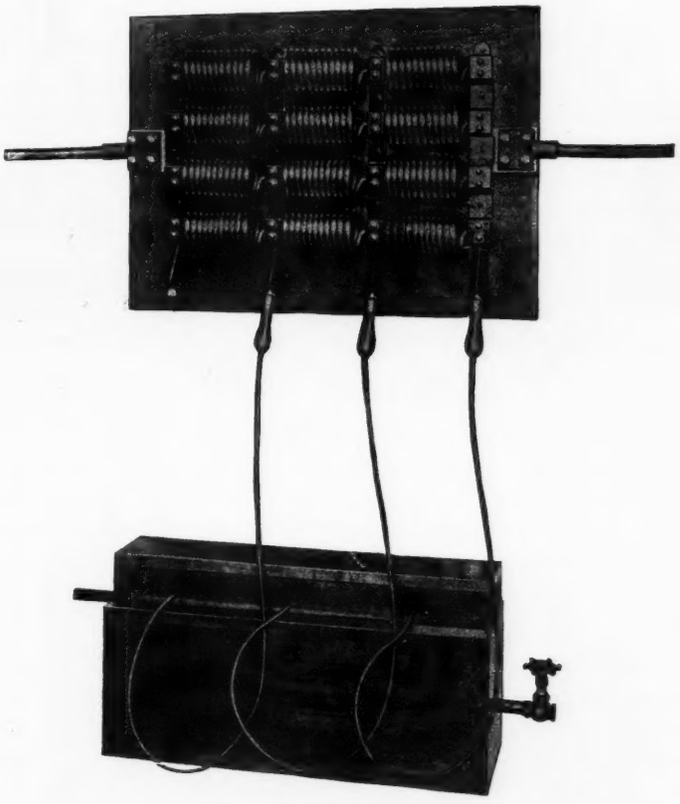


FIG. 3.—TANK LIGHTNING ARRESTER.

For larger outputs it is customary to provide a tank arrester for each feeder, rather than to use a single coil board of larger capacity.

The particular advantage of the tank arrester for protecting stations is found in the direct connections to earth through the water, which provide relatively low resistance paths to earth. The opportunities for discharge are three-fold, and thereby greatly lessen the possibility of failure due to the selective character of static discharges. The choke coils offer a high inductive resistance in the direction of the apparatus to be protected, and at the same time tend to force the discharges across the low resistance paths to earth. The connections to a water main insure a permanent and effective ground. The tank arresters need only be brought into service when a thunderstorm is threatening. During fair weather the connecting plugs may be removed and the water turned off. Other types of lightning arresters for use on direct-current arc circuits up to 4,000 volts are provided, and follow the same principle as type "K."

It is customary to install a single choke coil with each type "L" arrester when used on street cars. The multiple spark-gap choke coil, illustrated in Fig. 4 and shown diagrammatically in Fig. 5, is provided for this purpose. Bare copper wire is wound into a grooved wooden drum, and a copper strap placed in close proximity to several of the convolutions is connected to the line terminal of the lightning arrester. The discharge may pass from any one of the several convolutions to the copper strap, and thence through the arrester to the ground. This method affords several spark gaps, and advantage is taken of that peculiar characteristic of lightning discharges known as side flash, which causes sparking to occur sometimes at one point and sometimes at another.

Too much importance can not be attached to the provision of proper connections, which should be as short and straight as possible, from the arrester to the ground. A poor ground connection will render inefficient every effort made with choke coils and lightning arresters to drive the static electricity into the earth. A good ground connection from a bank of station arresters may be made in the following manner: First, dig a hole, six feet square, directly under the arrester until permanently damp earth has been reached, then cover the bottom of this hole with two feet of crushed charcoal, and over this lay 25 square feet of No. 16 tin copper plate. The ground wire, preferably No. 0 copper, should be securely soldered across the entire surface of the ground plate. The ground plate should be covered with two feet of crushed charcoal, and the hole filled in with earth, using running water to settle.

FIG. 4.—STREET-CAR CHOKE COIL AND LIGHTNING ARRESTER.

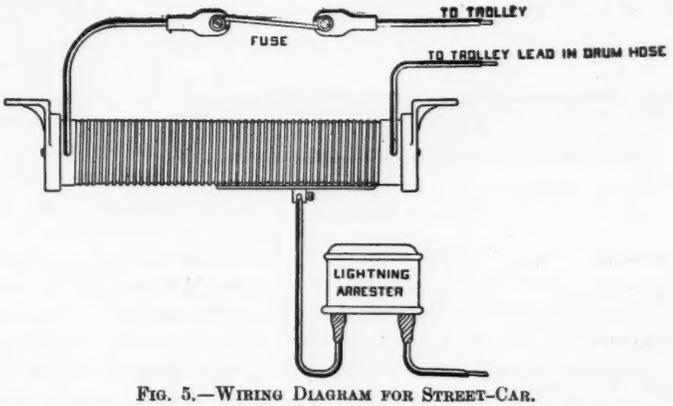


FIG. 5.—WIRING DIAGRAM FOR STREET-CAR.

Reflector Chandeliers.

As they are ordinarily installed, electric lamps are permitted to throw away a great part of the light they generate, since this light is radiated in all directions. Ordinarily, only that portion which strikes downward from the lamp is of value. Naturally, if the large amount of light which radiates upward or sideways is reflected back by mirrors downward, or, in other words, sent where it will do the most good, the value of the light is correspondingly increased, and may easily be more than doubled.

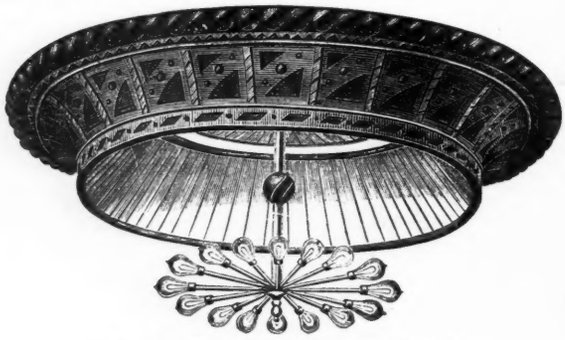


FIG. 1.—TRIPLE CONE CEILING REFLECTOR.

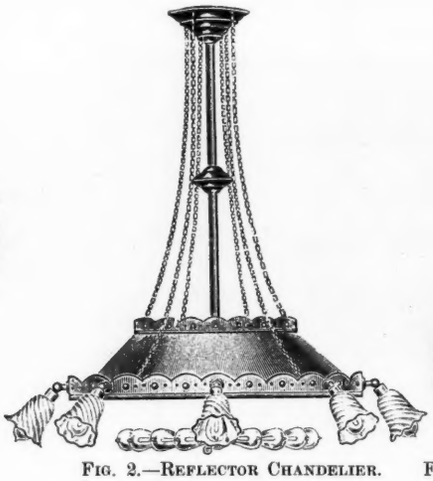


FIG. 2.—REFLECTOR CHANDELIER.

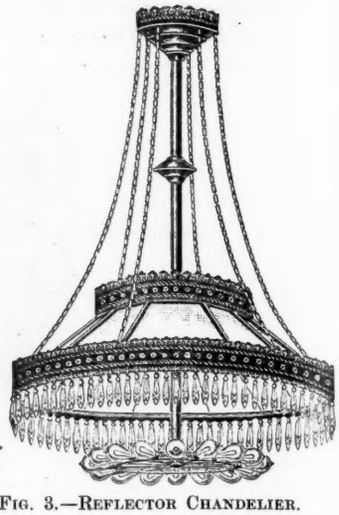


FIG. 3.—REFLECTOR CHANDELIER.

The accompanying illustrations are of several forms of reflector chandeliers constructed especially with reference to their use in churches, halls, theatres, lodge rooms, etc., in which advantage is taken of the foregoing principle. Fig. 1 is what is known as a triple cone ceiling reflector, and is made in sizes up to 110 inches in diameter and ranging from 16 to 60 electric lamps. Fig. 2 shows a form of chandelier of highly attractive appearance, intended to be swung from a high ceiling. Fig. 3 represents a reflector chandelier, ornamented with prisms and of more decorative design, intended for installation in somewhat more elaborate surroundings. Figs. 4 and 5 show types of very useful store window and picture reflectors, which can be so installed that the direct glare of the lamps does not reach the eye, but only a diffused, yet brilliant, illumination.

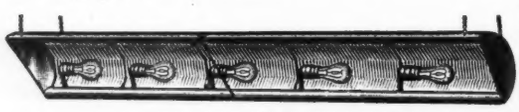


FIG. 4.—STORE WINDOW OR PICTURE REFLECTOR CHANDELIER.

The Wheeler Reflector Company, of Boston, Mass., manufactures these chandeliers, and also constructs a very large number of reflector fixtures of many different types for electric lighting, both arc and incandescent, as well as for oil and gas lighting.

A New Telephone Manufacturing Company.

The Bruckner Electric Company has been established, in New York, with general offices in the Electrical Exchange Building, at 136 Liberty street, and a factory and branch office in the Lexington Building, 141-155 East Twenty-fifth street. Mr. F. C. Bruckner, the former partner of the Schmidt & Bruckner Electrical Company, is president of the new organization.

The company starts under most auspicious conditions, and Mr. Bruckner says that he has been able to retain the most skillful workmen from his old shops. The company will manufacture a signal telephone apparatus of the highest grade for both interior, exchange and long-distance service; switchboards and other telephone appurtenances will also be manufactured, and it is the intention of the new company to develop a manufacturing organization which shall continue a success because of splendid workmanship, carefully selected materials and the adaptation of the most approved electrical and mechanical parts in the construction of its telephone apparatus. It is announced that the company will manufacture a telephone transmitter especially adapted for "central energy" system in which the carbon will neither deteriorate nor pack. The company already has many tangible orders in hand and the inquiries which it has received, even in the first few days of its career, are sufficient to keep its shops busy for a period.

An amendment to the charter of the Memphis, Tenn., Light and Power Company has been granted, increasing the capital stock from $300,000 to $500,000.

Electric Fire Engines.

TO THE EDITOR OF ELECTRICAL REVIEW:

Noting your article on "Electric Fire Engines," in your current number (July 11), allow me to call your attention to my letter to the New York *Times,* published February 14, 1898. At that time the street railroad currents were not existing, but the plan could be applied now to better advantage than I had proposed, using the illuminating current.

CHAS. J. BATES.

New York, July 11.

[No doubt the plan proposed has been mentioned several times in the past, on account of its obvious character. Electric fire pumps would be valuable even if they had to depend on the illuminating currents, as our correspondent suggests. Now that New York city is full of trolley lines the feasibility of the method is so entirely evident that is should not wait long for a trial in practice.—EDS.]

FIG. 5.—STORE WINDOW REFLECTOR CHANDELIER.

The Central Electric Light Company recently organized to gather in all the electric light companies in central New Jersey, has absorbed the electric light companies of New Brunswick, Perth-Amboy, Rahway, Metuchen and Bound Brook.

An Ingenious Commutator Truing Device.

The rapid development of electricity for motive power and other purposes, together with the varying conditions under which dynamos and motors are called upon to operate, has made it difficult, in many cases, to keep the commutators of such electrical apparatus in good condition. There is, therefore, a great demand for a satisfactory device for truing up the commutators. The accompanying engravings illustrate the "B. & B." commutator truing device, which is manufactured by the Fort Wayne Electric Works, Fort Wayne, Indiana, to meet the requirements of such work. The tool is very small and compact, yet it has the capacity of a large lathe and is claimed to make it possible for one man to accomplish results hitherto found impossible. It does its work well, owing to the fact that it is mounted on the shaft bearings proper, insuring a perfectly true commutator with its periphery concentric with the shaft.

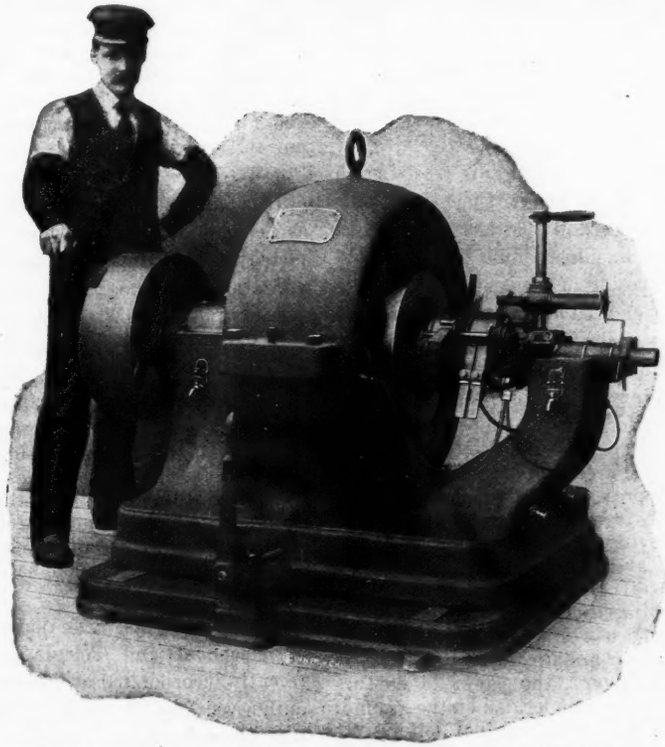


FIG. 2.—COMMUTATOR TRUING TOOL IN POSITION ON DYNAMO.

The turning is accomplished by adjusting the tool to the commutator face, then slowly revolving the device as a whole (Fig. 1), the tool itself being fed automatically in a horizontal direction. The depth of the cut can be quickly adjusted by means of a knurled attachment. In cases where it is undesirable to remove large and cumbersome armatures from the dynamos the turning can be accomplished by securing the device to the shaft bearing, either by removing the bearing caps or slipping out the pedestals, housings or other bearing-supporting devices (Fig. 2). The design of many machines is such that it is impossible to revolve the device as a whole, hence it was found necessary to furnish a clamp and handle which can be secured to the pulley and the armature revolved in its bearings, the truing device remaining in a fixed position. In this case the clamp which carries the bent steel rod is mounted on the end of the shaft, causing the detent to engage the star wheel as the shaft revolves, which makes the device self-feeding. The fact that the armature need not be removed, together with the short time required to rig up the truing tool, must be recognized in itself as an excellent recommendation.

General Electric Stockholders' Meeting.

A special meeting of the stockholders of the General Electric Company was held at Schenectady, on July 17, to vote on the proposition to increase the capital stock by $4,415,000 in order to retire outstanding debenture bonds. The proposition was authorized and the new stock will be allotted at par. The stockholders will benefit to the extent of from 20 to 25 per cent by this operation, equivalent to a dividend of about seven per cent.

The outstanding debenture bonds amount to $5,298,000, and the capital stock, including that authorized to be issued, to $25,242,200.

Boston Elevated Railway Company Increases Stock.

The board of railroad commissioners has granted the petition of the Boston Elevated Railway Company for the additional issue of capital stock to the amount of $9,500,000, the proceeds of said stock to be applied only as follows:

Three million one hundred thousand dollars shall be applied to the payment of the necessary cost of construction and

FIG. 1.—COMMUTATOR TRUING TOOL WORKING ON REMOVED ARMATURE.

equipment of the elevated structure of the railway, including foundations, tracks and electric system.

One million two hundred thousand dollars to payment of necessary cost of construction and equipment of terminal and other stations, exclusive of lands.

Fifty thousand dollars to payment of the necessary cost and equipment of Subway.

One million one hundred thousand dollars to the payment of the necessary cost of construction and equipment of power houses, exclusive of lands.

Six hundred thousand dollars to payment of the necessary cost of rolling stock and the equipment of same.

Three hundred thousand dollars to payment of the necessary engineering and miscellaneous expenses incurred during the construction of railway.

Three million one hundred and fifty thousand dollars for real estate and to the payment of damages occasioned by the construction of the railway, including the amount of the second deposit of $200,000 required to be made to the treasurer of the commonwealth.

SHELBYVILLE, ILL.—The Secretary of State has licensed the incorporation of the Hervey City & Southern Electric Railroad Company. The company plans the construction of an electric road from Hervey City to Shelbyville. The capital stock of the corporation is to be $150,000. The principal office of the road is to be located at Macon. The incorporators and members of the first board of directors are: J. Smith Butrum, Decatur; Robert B. Hennigh, Prairie Home; Robert H. Woodward, Harold R. Woodcock and John M. Turner, of Macon.

VIEWS, NEWS AND INTERVIEWS

The Association des Industrielles, in France, has offered a prize of 1,000 francs ($200) for the best design for insulating gloves for the use of linemen. The office of the association is at No. 3 Rue de Lutece, Paris, where additional information in regard to the competition may be obtained.

The Trenton, N. J., Street Railway Company, operating the entire street car service of this city, recently announced an increase of wages from $1.60 to $1.75 a day to motormen and conductors. The men made a demand for higher wages four years ago and were told then that the company would increase their pay when times grew better.

It is said that a London firm of electricians has brought out a new system combining decoration with the lighting of rooms. The main idea is the insertion of transparent panels faced with photographic positives of well-known pictures, through which filter subdued electric light, the effect being somewhat the same as the light of a church, and eminently becoming. There is no glare and the pictures can be chosen according to the taste of the owner of the room.

Vice-Consul Monaghan writes from Chemnitz to the State Department giving figures partly official and partly taken from private statistics showing the world's production of copper to have been 473,818 tons last year, as compared with 434,329 tons in 1898. This is an increase of 39,489 tons, or 9.1 per cent. North America produced 265,156 tons last year as compared with 239,241 tons in 1898, an increase of 25,915 tons, or 10.8 per cent. This is way above the production of any other part of the world, being over half the world's production. The figures show that the production is hardly equal to the demands, for, in spite of increased prices, it has advanced only a little over nine per cent.

The torpedo boat Porter has concluded some tests with the McGray electric log, held at Newport, R. I., at the order of Secretary Long. The board conducting the tests consisted of Lieutenant Bronough, Lieutenant Gillis and Ensign Halligan. The log is an ordinary rotator, on whose shaft a carriage travels back and forth, completing an electric circuit at every twentieth of a knot and registering on a dial placed on board ship. A battery of 12 dry cells will run the log 15,000 miles. At ordinary speed 150 feet of cable are required, and at 24 knots 250 feet of cable are used. The Porter was run from 10 to 24-knot speed and the log worked perfectly. One of the logs is now on board the flagship New York.

The following story is told by W. S. Churchill, in his "The River War," of the manner in which General Kitchener improvised a reel for field telegraph work in the Soudan. "He walked to the largest coil of wire, picked it up and approached the smallest donkey. He took the little animal's two hind legs in his left hand, and put them into the coil. He lifted the wire up until it passed around the donkey's back, like a horse collar, only that it hung between the fore and hind legs. He caught hold of the loose end of the wire, and smacked the donkey with the other hand. The beast moved forward, tripping and stumbling over the wire, which began, albeit jerkily, to unwind. Then he walked abruptly back to his horse. By this method the field telegraph accompanied the flying column."

Brigadier-General A. W. Greely, chief signal officer of the army, is receiving so many letters containing suggestions for devices to be used in the war of the nations of the world against China that the problem of disposing of the communications is a serious one. The inventive genius of the entire civilized world appears to have been stimulated by the news from China, and communications are received from many quarters of the globe, written in various languages. The letters received by General Greely and the signal office every day present countless ideas, ranging all the way from a cipher code to a scheme for destroying the combined forces of the "Boxers" at a single blow. The greater number of the ideas presented are wholly chimerical. For example, an inventor from a western state suggests the making of an airship, to be propelled by an electric motor, the power to be furnished by a dynamo located on the ground. To quote from the original letter: "It would be an easy matter for the allies to start an airship when they meet the 'Boxers.' The wire supplying the current could be dragged behind, as it is so light it would not interfere with the progress of the ship. If the ship can not be propelled by electricity, a gas engine can be supplied with gas by means of a long rubber hose."

Germany has given up the Réaumur thermometer, and after January 1, 1901, will use only the centigrade. In the Réaumur the division between the freezing and the boiling point is into 80 degrees, in the centigrade it is into 100 degrees.

TELEPHONE AND TELEGRAPH

The Indiana Telephone Company has been incorporated with a capital of $50,000. Its place of business is Hartford City, Ind. Messrs. W. B. Cooley, A. G. Lupton and H. O. Miller are the board of control.

The new owners of the Home Electric Light and Power Company, of Elkhart, Ind., at a recent meeting, elected the following officers: President, H. L. Crawford, of New York; vice-president, P. F. Thompson, of New York; secretary, James Du Shane, of South Bend; treasurer and general manager, A. M. Barron, of Elkhart. The above, with C. H. Tenney, of New York, constitute the directorate.

The civic board of control, of Toronto, Ont., at a recent meeting, passed a resolution recommending the city engineer to prepare an estimate of the probable cost of installing and operating a municipal telephone system for 6,000 and 10,000 subscribers. A committee of six, one from each ward, was appointed to consider the question. The Bell Company charges $45 yearly for business and $25 for house telephones, and refuses to put in a new one except for a material increase of rates.

It is announced that the Southeast Texas Telephone Company, whose line is completed from Trinity to Colmesneil, Tex., and also covers the greater portion of the Houston, East & West Texas Road, has closed successful negotiations for the right of way over the Texas & New Orleans Road from Beaumont to Huntington, and that work will begin next week on construction of the line connecting these two points. The line now extends from Lufkin to Huntington, the latter being a new town, 26 miles north of Colmesneil, in Angelina County, to which the Texas & New Orleans extension has been completed.

It was stated last week that the National Telephone and Telegraph Company, recently incorporated at Trenton, with an authorized capital stock of $50,000,000, was formed by the interests which are identified with the Telephone, Telegraph and Cable Company of America. These interests are understood to include the Widener-Elkins-Whitney syndicate. The primary object involved in the corporation is said to be the removal of the assessment feature of the stock of the Telephone, Telegraph and Cable Company of America, the new company taking the place of the last-named company. The Telephone, Telegraph and Cable Company of America was organized to buy, build and operate a telephone service throughout the United States, and it has been at work for some time upon its plans for a big independent telephone system,

A New Type of Reflector Lamp.

Much interest is taken in the possibility of a high efficiency incandescent lamp consuming two and one-half watts per candle or less. While such a lamp is, at present, impossible in the regular type, the General Electric Company have been able, by specializing the form of filament and lamp and by the use of a reflector concentrating the light in one given direction, to increase the practical efficiency of the incandescent lamp to a consumption of less than one and one-half watts per candle per unit of light in useful direction.

This lamp is known as the reflector lamp. The filament is made in a four-coil spiral, so as to give the maximum amount of light from the tip end of the lamp. The umbrella style of bulb, with a reflecting surface behind, secures a three-fold concentration of light in the given direction.

The reflector lamps are backed with a special reflecting composition, giving a highly polished mirror reflecting effect. The composition is durable and is not affected by the heat of the lamp. This backing can be furnished with an outside coating of Indian red enamel, green enamel, copper bronze, gold bronze or aluminum bronze, to suit any style of decoration desired. The lower half of the lamp can be furnished either plain or frosted.

The plain silvered lamp is best adapted to decorative lighting in show windows, and in ceiling and frieze lighting. For desk lighting, however, and reading purposes the frosted lamp is to be preferred.

These reflector lamps are very economical for conditions where a maximum amount of light is wanted in one direction. With the brilliant and beautiful lighting effects possible with this type of lamp, there should be a wide field of use for it in theatre, hotel, frieze, window and other forms of decorative lighting.

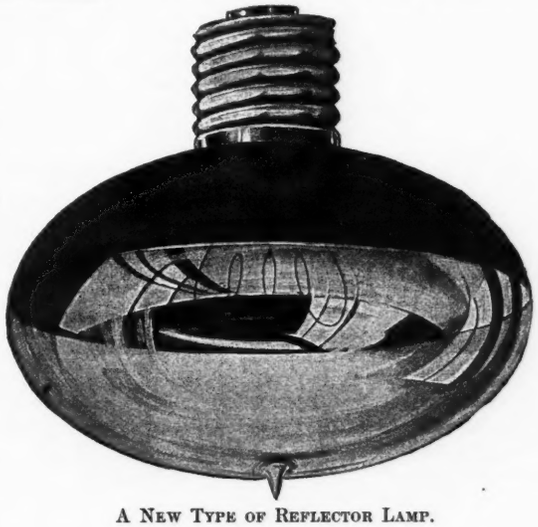
A decided improvement has been effected in the case of the arc light by the use of a reflecting shade concentrating the light in a useful downward direction. In the same way, the reflector lamp secures a great improvement in economy by saving the light which would otherwise be wasted in an upward and useless direction, concentrating it downward. The lamps are made in two sizes, 28 candle-power, consuming 38 watts, and 36 candle-power, consuming 50 watts, and can be furnished of any voltage or base desired.

ELECTRIC RAILWAYS

A preliminary survey has been made for the building of an electric railroad from Windsor to Chatham, *via* Essex and Belle River. The work of obtaining the right of way is now in progress.

Application for the appointment of a receiver for the Chicago Consolidated Traction Company has been made in the Circuit Court by Sutro Brothers & Company, New York, bankers and stockholders of the company.

A new trolley line is being built from Mamaroneck station to Larchmont Manor, N. Y., by the Larchmont Horse Car Company. The line is in operation to Rye Beach, and soon the residents of Rye, Port Chester, White Plains, Harrison, Elmsford and Tarrytown will have an opportunity to visit Larchmont Manor and Larchmont Park.



A New Type of Reflector Lamp.

The New York State Railroad Commissioners have been petitioned for permission to construct an electric road from Geneva to Rochester. A request to build from Seneca Falls to Auburn was refused, as the proposed line was parallel to the New York Central road. Permission was granted in case of the road from Watkins to Elmira, although the latter line is parallel to the Northern Central. There is much speculation as to the decision.

The directors of the Cumberland Valley Electric Passenger Railway Company have completed securing the right of way to Mt. Holly Springs, Pa., a distance of six miles from Carlisle. All of the track will be laid on private property, the right of way having been purchased. Work will be begun at once. It is proposed to follow this up by building the road to Berlin Springs and Churchtown, and then to Camp Hill, which will give a trolley service from Harrisburg to Carlisle, a distance of 19 miles.

A consolidation of the street railways and electric light systems, of Dubuque, Iowa, has been accomplished and hereafter all the electric power and light projects in Dubuque will be under one management. The consolidation means a revolution in the electric systems in Dubuque. All the electricity for both power and lights will be generated at the Star electric plant, where there is now being erected a new power house. This means the abandonment of the Iowa street power station, except that it may be retained and used for car barns.

The Union County board of freeholders has awarded to United States Senator John Kean a franchise for a trolley road extension from Elizabeth to Cranford, N. J. Senator Kean agrees to pay to the county $73,000, which is to be used in converting Westfield avenue into a boulevard of the width of 100 feet between Elizabeth and Cranford. Commissioners have made awards to property owners for land to be acquired. Some landowners donated land in order to promote the improvement.

President Vreeland, of the Metropolitan Street Railway Company, New York city, has announced that the prehistoric horse cars on the Thirty-fourth street cross-town line are to be replaced within 15 days by new cars of the electric storage battery system. The large cars with double rows of cross seats which have been in use on the Third avenue line are to be abandoned. One hundred of them were taken on trial, but have been condemned. "These cars were constructed," said President Vreeland, "with a view to service both in Summer and Winter. It was found, however, that the seats were cramped and that there was scarcely room in the aisles for one passenger to pass another."

Electrical Manufacturers and Copper.

[*From the Boston News Bureau.*]

A substantial advance on future purchases of copper is expected as an outcome of the copper trust, organized by the Rockefellers and the Rothschilds. The most significant feature of the situation is that the same interests which have finally cornered the world's copper market have also recently acquired heavy interests in the General Electric Company, the Western Electric Company and the Siemens-Halske Company.

CORPORATION NEWS

COLUMBUS, OHIO—The Ernes-Hopkins Company, of Columbus, has been incorporated for manufacturing electrical supplies. Capital, $10,000; incorporators: J. A. Ernes, W. A. Hopkins, Jr., F. R. Huntington, T. M. Livesay.

HARTFORD CITY, IND.—The Indiana Telephone Company, of Hartford City, has been incorporated with a capital stock of $50,000; directors: William B. Cooley, A. G. Lupton and Harry O. Miller.

SMITH'S FALLS, ONT.—The Citizens' Electric Company, Limited, of Smith's Falls, has been incorporated with $35,000 capital. Mr. J. H. Gould is president and Mr. J. S. Gould, secretary. The works are being enlarged.

MARTINSBURG, W. VA.—The National Automobile Company has been formed to manufacture automobiles. Incorporators: G. McGill, H. Wells, E. Sampson, J. Fisher, F. Turner, all of Martinsburg; capital, $1,500,000.

ATTICA, OHIO—The Attica Telephone Company, of Attica, has been incorporated to build and operate a telephone line. Capital, $2,500; incorporators: F. C. Myer, J. Schattler, R. T. Hearson, H. G. Blain, E. G. Blain.

NEW YORK CITY—The Auto-Storage Battery Company has been incorporated in West Virginia to do a general storage battery business. Incorporators: W. B. Smith, F. H. McCoun, C. O'Shaughnessy, J. Lee, L. J. McCormack, all of New York city; capital, $5,000,000.

NEW YORK CITY—The Seaside Electric Light, Heat and Power Company was recently incorporated. Capital, $5,000; directors: William Wainwright, Mrs. Sarah Tator, John Remsen, W. G. Wainwright and John W. Wainwright, New York city.

TRENTON, N. J.—The Arnold Monophase Electric Company, of Trenton, has been chartered for the distribution of electricity. Capital, $500,000; incorporators: C. T. Eggleston, of Philadelphia; F. B. Lee, N. L. Petty, both of Trenton; F. B. Lee, attorney, Trenton.

WILMINGTON, DEL.—The International Light, Heat and Power Company, of Wilmington, has been incorporated for manufacturing light, heat and power. Capital, $500,000; incorporators: O. B. Thatcher, of Palmyra, N. J.; G. Ford, W. M. Patton, D. M. Rattay, W. M. Pyle, all of Philadelphia, Pa.

CORTLAND, N. Y.—The Croton Electric Light and Power Company, of the town of Cortland, Westchester County, has been chartered with a capital of $10,000; directors: James Murray Mitchell, Robert P. Barry and Armitage Mathews, New York city; Henry M. Haviland, Brooklyn, and Joseph R. Swain, Sing Sing.

PEEKSKILL, N. Y.—The Peekskill Lighting Company has been formed to manufacture electricity and gas for light, heat and power purposes. Capital, $50,000; directors: Benjamin B. Nostrand, Jr., Peekskill; H. Hobart Porter, Jr., and Francis Blossom, New York city.

TRENTON, N. J.—The St. Lawrence Gas, Electric and Transportation Company has been incorporated with $400,000 capital stock. The company is a consolidation of all the gas, electric and traction companies of St. Lawrence County, and it is understood that P. A. B. Widener and W. L. Elkins, of Philadelphia, are interested in the deal.

ST. LAWRENCE COUNTY, N. Y.—The St. Lawrence Gas, Electric and Transportation Company has been incorporated at Trenton, with an authorized capital of $400,000, all common stock. The new company is a consolidation of the gas, electric light and trolley companies of St. Lawrence County, N. Y., and, it is understood, is controlled by the Widener-Elkins syndicate.

TRENTON, N. J.—The National Telephone and Telegraph Company has been incorporated with a capital stock of $50,000,000. The incorporators are Joseph B. McCall, A. Louden Snowden, Harry J. Verner and James F. Sullivan, of Philadelphia, and Huelings Lippincott, of Camden. The company is authorized by its charter to "construct, maintain and operate electric telephone and cable lines within and across the Hudson River in connection with lines in New York now or to be established and thence with lines in other states and territories, colonies and foreign countries," and to operate a system of telegraph with or without wires.

LEXINGTON, O. T.—The Purcell Electric Company, with its main office at Lexington, O. T., and a branch office at Purcell, I. T., has been chartered. The company proposes to supply both places with electric light and power, a telephone system and an ice manufacturing and cold storage plant. The time of the charter is for 20 years and the capital stock is $20,000. The following are the directors: L. G. Wantland, Purcell; O. J. Nichols, Purcell; W. G. Blanchard, Purcell; R. B. Stichter, Purcell; S. C. Hawk, Lexington; Neal Smith, Lexington.

A franchise has been granted by the Shasta County, California, Supervisors to the McCloud River Electrical Power Company. The company intends putting a railway between Redding and Copper City, a distance of 30 miles, and expects to have it in operation within a year.

The city of Wellington, Kas., will install and operate a municipal electric lighting plant. Machinery and apparatus for 50 arc and 1,000 incandescent lights will be required.

EXPORT NOTES

The Morris Electric Company, of New York city, has received an order for several hundred tons of lap-riveted sheet-iron pipe, which will be utilized by the Havana Electric Railway Company. The order calls for pipe varying from 7 to 30 inches in diameter.

On August 18, according to the Madrid *Gazette,* the concession to construct a system of electric tramways in Barcelona will be awarded. It is quite possible that either English, Belgian or German contractors will secure the concession, but as considerable American machinery is already in use in similar undertakings in Spain the requisitions for the Barcelona line will be watched with considerable interest by manufacturers in this country and abroad.

There are said to be inquiries in the market for three 250-kilowatt street railway generators for a trolley line in Natal, South Africa, also for five 250-kilowatt machines for a railway in Canada, says the New York *Journal of Commerce.* A Japanese road is asking for bids from local manufacturers for a 225-kilowatt dynamo. Nearly all the large electrical engineering firms are engaged in work for foreign roads as extensively as for home demands. It is only in supplies that business in the electrical line is not as active as it was this time last year, but, on the other hand, heavy railroad work is more in evidence, and each season, even in the countries where home competition is keen, they are adopting American systems.

An Ingenious Inspector.

[*From the Philadelphia Record.*]

Up at the Ridge avenue car barns there is a young inspector of registers who will some day make his mark as the inventor of some great labor-saving device. There is nothing particularly arduous about the duties of these inspectors. They simply jump aboard the car, make a record of the number of the passengers indicated by the register and jump off again. But the young inspector in question doesn't even do this. Sometimes it is a rather difficult thing to get a peep at the register when a Summer car is uncomfortably crowded, so he just stands on the step with his back to the end of the car where the indicator is situated, pulls a hand mirror from his pocket and holds it before his face at an angle which will reflect the indicator. Of course, the figures are reversed in the mirror, but practice has made him an adept at transposing them. That young man's mind is too fertile for his job.

BOOK REVIEWS

The Electro-Magnet, edited by Townsend Wolcott, with a second part by Richard Varley. Flexible leather, 4½ by 6¾ inches, 64 pages with ruled sheets, tables, etc. Fifteen illustrations. Published by the Varley Duplex Magnet Company, Jersey City, N. J., 1900. Supplied by the ELECTRICAL REVIEW at $1.00.

In Mr. Wolcott's part of this excellent little volume he has set forth the fundamental law of the electromagnet with such clearness and simplicity and so good an understanding of what was needed, that he has produced a book that can not fail to have permanent value. Mr. Varley's part of the book consists of working methods for culculating electromagnets and tables giving details not generally published about insulated wires such as are used in magnet construction. A plate engraved like a slide rule is a valuable addition to the work. The book is well and substantially made, and should prove to be of value to the working electrician.

SOME ELECTRICAL GAIETIES.

A RHODE ISLAND CLAMBAKE.

Mr. W. L. Candee, of New York, and Mr. A. C. White, of Providence, gave a very delightful Rhode Island clambake to a number of their friends at the Pomham Club, on Narragansett Bay, on Tuesday of last week. A number of gentlemen went over from New York and were joined by a party of Providence gentlemen. Mr. White extended to all of them the courtesy of the club, and one of the finest clambakes of this season was participated in with great zest and enjoyment.

Among the gentlemen present, in addition to the hosts, were: Mr. U. N. Bethell, general manager of the New York Telephone Company; Mr. Geo. T. Manson, Colonel A. G. Perham and others, of New York city; Hon. Chas. C. Gray, auditor of Rhode Island; Alderman Ira Winsor, Samuel Whitley, Captain Benjamin Hall, superintendent of the Soldiers and Sailors' Home, of Rhode Island; Colonel Isaac M. Potter, ex-Senator Walter W. Whipple and Commodore W. B. Banigan.

After the bake a sail down the bay was taken in the handsome steam yacht Llewellyn, through the courtesy of her owner, Commodore Banigan, which concluded a very enjoyable day of relaxation for the electrical visitors.

ELECTRICAL MEN AT CONEY ISLAND.

The advantages of New York city as a Summer resort are well recognized by the electrical fraternity. Last week quite a number of gentlemen prominent in the electrical field were attending a meeting in New York city, and in a body participated in a chartered steamboat ride up the Sound, lunched at the New York Athletic Club, at Travers Island, and afterwards visited an interesting point of land projecting into the water, known as Coney Island.

Special electric cars carried the party from Fifty-second street, South Brooklyn, to the Hotel Brighton, Brighton Beach, where an elaborate dinner was enjoyed to the music of the joyous waves of the sea. Subsequently a visit to the points of interest at Coney Island was made, the recollection of which will long remain in the minds of every participant, and it is said even the imperturbable regulars at Coney Island will never forget this whirlwind visit of the electricians.

Among those who were in the city, quite a number of whom participated in the outing, were the following-named gentlemen: Charles E. Brown, Central Electric Company, Chicago; W. W. Low, Electric Appliance Company, Chicago; C. B. Price, Pettingell-Andrews Company, Boston; W. C. Bryant, Bryant Electric Company, Bridgeport, Ct.; H. T. Paiste, Paiste & Company, Philadelphia; H. C. Roberts, Roberts & Company, Philadelphia; F. H. Stewart, Stewart & Company, Philadelphia, and Messrs. H. Adams, F. S. Brown, H. C. Cushing, Doubleday, Glover, Grier, Lawrence, Marshall, Palmer, H. R. Phillips, Scudder, Thomson and Parker.

Platinum in Electric Lamps.

It has been generally believed that platinum was used for the leading-in wires of incandescent lamps, on account of the fact that its coefficient of expansion is the same as that of glass, says the London *Electrical Engineer*. Owing to this belief, several misinformed inventors have experimented with various alloys, and found a means of varying the coefficient of expansion by varying the proportion of the different metals used, and thereby obtaining the desired similarity with that of glass. The objection to the use of other metals than platinum is, on the contrary, not discrepancy in thermal expansion, but the fact that all but platinum oxidize. No matter what care is taken to keep oxygen from the metal, a thin film forms around the wire between it and the glass, allowing a slow leakage of air, which gradually breaks down the high vacuum necessary for good incandescent lamps.

BUSINESS NOTES.

The Fort Wayne Electric Works, of Fort Wayne, Ind., has issued List No. 10 of plants operating Wood apparatus. The list forms a neat booklet and is accompanied by another booklet showing pictorially the progress of the Wood system of generators since the first machine was built in 1879. The Wood arc lamps are also illustrated in a similar manner.

A new carbon brush has just been brought out by the Speer Carbon Company, of St. Marys, Pa., and christened the "Long-Lived" motor brush, because it is believed to be the most durable and best wearing brush yet introduced on the market. The company has spent several months demonstrating the superiority of these brushes to the consumer, and is glad to submit samples of them to any one desirous of making tests of their excellent qualities. A large number of electric railways have tested the new brush and have universally reported that it lasts from one-half to two-thirds longer than any other brush on the market. This brush is the result of experiments and investigation by Mr. J. S. Speer, the head of the company, who recently visited the Atlantic coast and placed orders for large numbers of the new brushes.

The Warren Electric Manufacturing Company, Sandusky, Ohio, through its Chicago agents, has been awarded the contract for the new Urbana, Ill., electric light plant. It will install one 60-kilowatt, 250-revolution and one 120-kilowatt, 250-revolution direct-connected Warren alternators to Ideal engines. This plant will be particularly interesting aside from its direct-connected features, from the fact that each dynamo will have an output of 7,200 alternations of 220 volts on one side of the machine and 2,200 volts on the other, thus running a three-wire system without transformers for the nearby lights and a high-pressure system for the lights at a long distance from the plant. A beautiful switchboard will be installed and Warren Electric Manufacturing Company's transformers used throughout. Also, the city of West Hammond, Ill., has awarded the complete new electric light plant, comprising two 30-kilowatt Warren alternators and one 40-light arc machine to the Warren Electric Manufacturing Company, of the Monadnock Building, Chicago. A new building in this city will be erected, boilers added and the old plant will be completely overhauled.

Mr. George A. McKinlock, president of the Central Electric Company, Chicago, is an enthusiastic devotee of golf. At a recent game, at Long Branch, Mr. McKinlock carried off the honors notwithstanding the fact that a number of the best amateurs of the East were participants.

INDUSTRIAL NOTES

Geo. Schwalm & Company, Harrison, N. J., are buyers of burned out and broken incandescent lamps.

The Joseph Dixon Crucible Company, Jersey City, N. J., is out with its regular monthly calendar blotter carrying a design appropriate to the season.

C. F. Bescano, Detroit, Mich., announces that he is prepared to quote low figures on early orders for oak pins and brackets perfectly turned from clear, sound lumber.

The Electric Appliance Company, Chicago, desires to call attention to the fact that the rush for Dayton fan motors is now on and that orders for immediate delivery should be received at once.

G. A. Crosby & Company, 28-34 Archer avenue, Chicago, Ill., is advertising a new milling and die-sinking machine, particularly desirable for electrical work. This company also manufactures presses, dies and sheet-metal machinery.

The Monarch Fire Appliance Company, New York, manufacturer of the dry fire extinguisher compound "Kilfyre," gave a practical exhibition of the efficacy of "Kilfyre" as a fire extinguisher at the foot of Wall street, New York, recently.

Hartwig & Miller, Detroit, Mich., are manufacturers of the Anthony boring tool, now being largely used by electricians for interior wire construction. The tool is ingeniously constructed for this work so that it greatly facilitates the electrician's labor.

The Connecticut Telephone and Electric Company, Meriden, Ct., manufacturer of telephone and telephone equipments, has just issued catalogue No. 6, which shows, by careful illustrations and descriptions, the many types of telephone specialties now made in its shops.

"Coal at one end, power at the other—the lubricant in between," is the title of a leaflet issued by the Joseph Dixon Crucible Company, Jersey City, N. J., as an argument favoring the use of Dixon's pure flake graphite as a lubricant. The leaflet may be obtained free on application.

The Ferracute Machine Company, Bridgeton, N. J., has just issued a catalogue of presses and dies. The catalogue contains many illustrations of machines which are particularly adapted for the equipment of electrical shops. It announces that a larger and more voluminous catalogue is in preparation.

The Emerson Electric Manufacturing Company, St. Louis, Mo., is carrying out a system of value to buyers of apparatus in the East, showing just what stock of electric desk and ceiling fans are on hand at the moment in its New York warehouse, 136 Liberty street. The bulletin for the week beginning July 14 is just at hand.

Machado & Roller, 203 Broadway, New York city, the well-known dealers in electrical instruments, announce that they have turned over their business as a whole to a corporation of the same name which will carry it on as heretofore in every particular and at the same address. By means of incorporation the firm acquires increased facilities for carrying on its rapidly growing business.

The Franklin H. Kalbfleisch Company, 31 Burling Slip, New York city, has published a booklet entitled "Something about storage batteries, electric vehicles and electrolyte." The main body of the little book consists of an excellent practical article on storage batteries, their construction and method of operation, by Geo. T. Hanchett, S. B., and is illustrated by a number of engravings showing standard forms of plates. The booklet is highly interesting, and may be had upon application to the above address.

Mr. Richard Harding Davis's article on "Pretoria in War Time," in the August Fiction Number of *Scribner's,* gives a sympathetic impression of the dignified and vigorous personality of President Kruger and of his attitude toward the war, and contains some comments on the conduct of captured British officers that will cause a lot of discussion. Mr. Davis says: "Some day we shall wake up to the fact that the Englishman, in spite of his universal reputation to the contrary, is not a good sportsman because he is not a good loser."

Harrison Brothers & Company, Philadelphia, are now introducing the Harrison primary cell for open circuit work. This cell has been greatly improved and developed since it was first introduced, two years ago, and it is claimed to be the most reliable cell manufactured, eliminating creeping salts and local action of zinc. The negative elements consist of lead peroxide and the positive elements consist of self-amalgamating zinc. It is further claimed to have a capacity of 40 ampere-hours and electro-motive force of 2.5 volts. The Thermo-Electric Company, Times Building, New York, are the sole agents for this cell.

The Wheeler Reflector Company has moved into new offices at No. 100 Purchase street, Boston, Mass. This is one of the pioneer companies in this line of manufacturing. The company has recently issued two new catalogues; one, known as "No. 21," is devoted to electric chandeliers for electric, gas or oil lighting, and well illustrates and describes the numerous types of window reflectors, tin shades, street lamps, lanterns, etc., and also outlines the company's facilities for special construction work of this nature. The second catalogue, known as "No. 22," is devoted entirely to reflectors and fixtures for street cars, particularly street car headlights.

The New York Central & Hudson River Railroad Company has just brought out a pamphlet describing the geographical, geological, botanical, zoological and other information that can be had by making short trips over its lines, especially to the new Bronx Park, in the northern extension of New York city. The pamphlet is called the "Pilgrimage System of Teaching," and is addressed to all those who wish to educate either themselves or their children, and particularly to school teachers. There is a great deal of very interesting historical and other information in the pamphlet, which reflects much credit upon the enterprising general passenger agent of the "Central," Mr. George W. Daniels.

The General Incandescent Arc Light Company, of New York city, has issued the following circular letter signed by Second Vice-President Martin J. Insull: "The business which has heretofore been carried on by the Martin J. Insull Company, of Chicago, will, on and after July 1, be conducted by us under our own name, with western headquarters at 48 West Jackson Boulevard, Chicago, and with sub-offices at Milwaukee, Minneapolis and Denver. The present representatives of the Insull Company in the cities named will in future act for us, under our Western sales manager, Mr. Francis Raymond, who will be located at the Chicago office. It is our intention to carry at our sub-offices sufficient stock of G. I. apparatus to fill immediate demands and a larger stock in Chicago from which the other offices may draw when quick deliveries are essential. As we act in the capacity of selling agents for the General Incandescent Lamp Company, of Cleveland, Ohio, manufacturers of the G. I. incandescent lamps, and with whom we are closely affiliated, a full stock of their products will also be kept at our new offices."

The Central Electric Company, Chicago, is just in receipt of the following unsolicited communication from a customer to whom it shipped a 12-horse-power, type "N," enclosed-end Bullock motor, the Central Electric Company representing the Bullock Electric Manufacturing Company as general sales agents. "The 12-horse-power motor is perfectly satisfactory; in fact, too good for the mining company by whom it is used, as the following will show. The motor is working on a pump 250 feet down in a mine, and, owing to the condition of the mine, it is sometimes half covered with water. It lifts a stream of water, three inches in diameter, 250 feet. It handled the load nicely until one day a new man, with very little experience in handling pumps and no experience in electric motors, started the pump without first letting the water out of the pipe. The result was that the pump was broken beyond repair, while no damage whatever was done to the motor. It seems that this is an accident that very often happens, but in every other case the motor has gone up in smoke. After this one experience, all electricians here have a great deal of respect for the Bullock motor."